فحص الجثث المتحللة في المركز الوطني للطب الشرعي، الاردن : التحليلات الانثروبولوجيه الشرعية

The Examination of Decayed Corpses at the National Institute for Forensic Medicine (NIFM), Jordan: A Forensic Anthropological Analysis

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Dedication

To my parents

To my Brothers …….. Sisters

To Ahmad Al-Harases

Acknowledgment

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Abstract:-

Al-Lahaseh, Khawlah Khalil. The Examination of Decayed Corpses at the National Institute for Forensic Medicine (NIFM), Jordan: A Forensic Anthropological Analysis. Master at Yarmouk University, 2012 (Supervisor Prof. Dr. Abdulla Al-Shorman).

This study aims to examine 19 corpses at the National Institute for Forensic Medicine (NIFM) to identify sex, age, stature and ancestry, estimate the cause of death if possible and the manner of death, investigate circumstances around death and identify the time elapsed since death. In addition to determine if the traumas is post mortem or ante mortem. This study tries to assist the medical examiner in solving the various cases, highlight the role of the forensic anthropologist in Jordan in his/her ability to examine these skeletons by using the anthroposcopy, x-ray radiography and anthropometry. The results indicate that the age of the sampled individuals is 20-30 years old, and the parentages of females are higher than males. Most of the cases are of a white ancestry. Some of the cases were in very good preservation condition. Due to the absence of missing reports at the NIFM, positive identification was not performed. The cause of death was mainly due to blunt traumas but a number of cases were remained unknown. Jordan has a varied geography, where some areas may preserve buried corpses. The forensic

anthropologists in Jordan were not involved yet as experts in the field especially when severely decomposed bodies are present.

الملخص باللغة العربية

تهتدف هذه الدراسة اللى تحديد هوية ١٩ جثه موجوده في المركز الوطني للطب الشرعي عن طريق تحديد الجنس والعمر عند الوفاه والطول والسلاله، وتحديد سبب الوفاه اذا أمكن وحالة الوفاه.
والتحقيق في الملابسات حول الجريمه وتحديد الوقت المنصرم على الوفاه، بالاضافة الى تحديد الاصابه إذا كانت قبل الوفاه أو بعد الوفاه. ومحاولة مساعدة الطبيب الشرعي في حل القضايا. وإبراز دور الانثروبولوجيا الشرعية في الاردن في قدرته على فحص هذه الجثث عن طريق استخدام المنهج الانثروبولوجي في فحص العينات نظريا وبصور الاشعه والقياس المتري، وتم الحصول على النتائج التاليه: معظم الجرائم تقع في سن العشرينات والثلاثينات لكل من الذكوروالاناث، نسبة الاناث أكثر من الذكور، نسبة السلاله البيضاء أكثر من السلاله السوداء. معظم الحالات حفظت بشكل جيد. لم يتم اجراء تحديد الهوية الايجابي نتيجة عدم وجود معظم التقارير الطبيه في المركز الوطني للطب الشرعي. وجد أن سبب الوفاه لمعظم الحالات كان نتيجة الاصابه بأداة غير حاده وهناك بعض الحالات لم نستطيع تحديد سبب الوفاه. تتنوع الاردن جغرافيا في المناخ بحيث أن بعض المناطق تعمل على حفظ الجثث المدفونة. وهناك اهمال كبير للانثروبولوجيا الشرعيه في الاردن بالرغم من ان هذه الحالات هي من اختصاص الانثروبولوجيين الشرعيين.

Keywords:-

Forensic Anthropology, Radiography, Mummy, Jordan and Corpses.

CHAPTER

ONE

Chapter One

Introduction:-

Forensic anthropology in Jordan is not practically adopted by either the Ministry of Health or the various forensic departments. On the academic level, the published researches in this field are few (Al-Shorman, 2005; Al-Shorman and Al-lahsih, 2012) and the specialists in the field are actually academics at the department of anthropology, Yarmouk University. In addition, the purpose of conducting such a research in Jordan is purely academic and does not contribute to the integration of forensic anthropology in forensic medicine. Despite the presence of many case studies in the various forensic centers in Jordan that need to be studied and examined, little if any cooperation existed between the forensic anthropologists at Yarmouk University and these centers. The work of the forensic anthropologist completes the work of the medical examiner, especially when dealing with skeletal remains, severely decomposed bodies, burned corpses or mummies (Steven, 2002; Dupras, 2006; Cattaneo, 2007 and Cordner, 2011).

Forensic anthropology has been greatly developed recently marked by the appearance of several books and articles worldwide. For example, the book entitled 'Forensic Recovery of Human Remains' deals with the crime scene

and the tools and techniques used to recover skeletal remains as well as the evidence of plants and insects and how they are collected and examined in order to determine the post mortem interval (Dupras, DSchultz, Wheeler and Williams, 2006). In addition, the book of 'Forensic Entomology: An Introduction' explains the types of insects that accompany the corpse decomposition and estimate the post-mortem interval based on the size and length of the insect. These and other resources enable the researcher in forensic anthropology to investigate related cases on a scientific basis, mainly, those with undergraduate or graduate degrees in anthropology.

The current study aims to investigate a number of forensic cases (no. = 19) available at the National Institute for Forensic Medicine (NIFM), Amman, that were found in the different geographical locations in Jordan of different ages and both sexes. These cases suffer extreme decomposition and some of them are partially or totally desiccated. These cases were stored at the morgue of the NIFM for years without examination and claimed to be out of the scope of the medical coroner and forensic pathologists.

Goals:-

The study aims to achieve the following goals:

1. Identify the corpses in terms of sex, age, stature and ancestry.

2. Estimate the cause of death if possible.

3. Investigate circumstances around death.

4. Estimate the time elapsed since death.

5. Estimate the manner of death.

6. Study the associated traumas and know if they are ante mortem or post mortem.

7. Assist the medical examiner in solving the cases.

8. Highlight the role of the forensic anthropologist in Jordan in his/her ability to examine these skeletons.

9. Elaborate on the social and geographic distribution of crimes in Jordan.

Research Question:-

This study tries to answer the questions surrounding the individual identity (age, sex, ethnic affiliation, and stature) and the circumstances around death for each case (manner and cause of death). The other questions entail the forensic context and forensic protocol that are adopted internationally.

Research Problem:-

Many of the forensic cases that reached advance stages of decomposition, partial or complete skletonization in Jordan, have been examined in a non-anthropological way or even not examined at all. These cases hold a lot of important information about the identity of the corpse and the circumstances around death. The number of such cases is continuously increasing coupled with an increase in the number of missing individuals all over the country. Besides, there is a lack of cooperation among the forensic anthropologists and the medical examiners in the country probably due to the knowledge deficit regarding the work of the forensic anthropologist among medical examiners and pathologists. Such cases hold important information that may contribute to the academic excellence at the Jordanian universities, but unfortunately locked up inside these corpses.

Hypothesis:-

First:

H_0: The forensic cases in Jordan follow a special geographical pattern, assuming that the micro-cultures in Jordan may possess a role.

H_1: The forensic cases in Jordan do not follow a special geographical pattern.

Second:

H_0: The demographic characteristics (age, sex, stature and ethnic affiliation) of the examined cases are similar to those of the Jordan's population.

H_1: The demographic characteristics (age, sex, stature and ethnic affiliation) of the examined cases are similar to those of the Jordan's population.

Materials and methods:-

In this study, skeletal remains that belonged to 19 individuals were examined, of both sexes and various ages, which are stored at the NIFM, Amman. The sample includes fully and partially skeletonized corpses, and naturally mummified remains. The study relied on anthroposcopy (visual examination of the corpses) and radiological imaging. Besides, anthropometry was used to estimate stature using an osteometric board, a spreading caliper and a sliding caliper. The radiographs were performed at the NIFM. The demographic variables (age at death, sex, ancestry, and

stature) were estimated according to the standards by Buikestra and Ubelaker (1994), and time elapsed death was estimated according to Byeres (2002).

CHAPTER

TWO

Chapter Two

Literature Review:-

Positive identification

The forensic anthropologists can determine the identity of the deceased using several methods. For example, the examination of the frontal sinuses as Da Silva has done in a study of an adult male that died in a traffic accident. He collected post mortem facial photographs, finger prints, and DNA samples, but they could not identify the deceased. They succeeded in comparing post mortem and ante mortem X-rays of frontal sinuses by matching both shapes (Da Silva, 2009). Similarly Fujita (2002) found a complete tripartite and a complete symmetric bipartite bone in the inter-parietal region of the occipital bone, called Inca bone . In a study that was conducted on a decomposed cadavers by Kahana (2002), the visualization of ante and post mortem x-rays from supra pelvic and pelvic areas, and further comparison of the location and configurations of pelvic phelebolиths allowed to match specific marks to find a consensus shape, location, number and relation to each other. These benchmarks help to determine the identity by comparing post mortem and ante mortem X-rays of missing people with deceased ones as they could not be identified by Deoxyribo Nucleir Acid (DNA) or fingerprints. Another

applicable method of identification relies on the use of benchmarks, for example, Nozawa (2002) examined the body of a deceased and noticed an extra vertebrae; a transitional vertebra between T12 and L1. Another study was conducted by Ruder (2012) who compared ante mortem paranasal sinuses CT scan images with post mortem ones. This technique is useful in individual cases and also in disasters, where mass deaths might present.

Mass deaths

A study was conducted by Bux (2006) on 18 victims from a plane crash in 2002 in Nepal, in order to identify them, aged between 35 - 64 years, 7 of them were males and 7 were females. To identify them, ante mortem and post mortem dental records, personal documents, jewelry, remnants of clothing and anthropological data were compared. Eleven ante mortem dental records were obtained but no ante mortem radiographs. After completion of the identification process, soft tissues were sampled from the jaws, which were x-rayed and re–examined by dentists after 6 months. The ante and post mortem data were compared with the result of re-examination. The visual identification was complicated in the cases with severe decomposition, and so they used personal belongings, physical characteristics, fingerprints, dental examination and genetic data. The dental identification is of great practical value in cases of mass disasters and

difficult in high impact and high temperature accidents with extensive dental fracturing or in cases of lost teeth or jaws. In a study conducted on two mass graves in the Balajnica, Serbia, Djuric (2007) collected ante mortem and post mortem data from clothing, foot wear, jewelry, physical description, medical and dental records. The post mortem data was collected from clothes of the victims and traumatic perimeter, while the author collected data including morphological markers of sex in the skull and pelvis, age assessment, and estimation of stature. In addition he collected blood samples from relatives and DNA extracted from the teeth and bones. He concluded that the best method to identity the bodies in mass graves are classical marker, the medical records were of weak use and DNA analysis were rejected.

In a study conducted by Schuller-Go¨tzburg (2007) on non–Thai victims, they identified 80% of the victims by dental identification. They collected the post mortem data, including medical characteristics, DNA samples, fingerprints, personal possessions, detailed dental analysis and periapical radiographs, comparing ante mortem and post mortem dental data to the victims in Phuket/Thailand. The literature bounds in forensic methods that entails the positive identification of victims either as in individual cases or mass deaths (Lieonart, 2000; Meyer, 2006; Slaus, 2007; Rios, 2010; Cavard, 2011). A DNA polymorphisms analysis is a useful technique in cases of

mass deaths (Mannucci, 1995), the genetic identification is the most effective tool in 21st century to determine the external appearance of the individual, to draw a conclusion about the geographical origin and determine biological relationships between individuals. This method is a useful tool in cases of natural disasters. In 1985 the analysis of protein and blood group polymorphisms was a great achievement, and then the DNA fingerprints appeared. In 1980s the DNA profiling replaces DNA fingerprints, and recently the Polymerase Chain Reaction (PCR). This method analyzes deteriorating DNA which could not have been identified in the previous methods. In some countries they store DNA profiles in databases as a digital profile. The Linate air crash resulted in 118 victims in 2001, carrying out visual anthropological, odontological and genetic analysis on victims, the best approach was to select a case by case, as each mass disaster is regarded as unique. Some of the cases were identified visually, while others were identified by matching ante mortem and post mortem dental x-rays or by DNA analysis (Piccinini, 2004; Hartman, 2011).

Natural disasters may occur in remote locations, therefore transportation of tissue samples to forensic laboratories for DNA profiling to identify victims can take weeks without refrigeration. In victims of disasters from tropical climates, samples should be taken and processed as soon as possible to avoid

degradation. Dehydration, solid NaCl, Dimethy 1 sulphoyide, Ethanol, Ehanol + EDTA, TENT louffer, RNA later, DNA Genotek and DNA Agrad may preserve such tissues at less than 35 °C. Female civilian victims of the 1991 war in Croatia have also been identified with DNA tests, dental records, ante mortem fractures, ante mortem surgeries, tattoos, personal documents, personal jewelry and personal artifacts in addition to the determination of sex and age at death (Slaus, 2009). Especially when accompanied by studying the inherited characteristics of parents and relatives, dental records, fingerprints and personal reports or clinical investigations, such as, X-ray or surgery (Simpson, 1979).

Forensic odontology

Forensic odontology is an essential part of forensic science and it plays a major role in establishing a positive identification , especially in cases where the bones are fragmented or disfigured and on natural or man - made disasters (Cordner, Woodford and Bassed, 2011; Lain, 2011). Teeth are an excellent source of DNA . Dental identification made by comparison with post mortem dental profiling is useless when ante mortem record is unavailable (Hill, 2011; Dostalova, 2012). Forensic ondontologists use a wide array of methods in identification, such as scanning electron microscopy Charlier (2010), x-ray radiography Dedouit (2007), stable

isotopes (Aggarwal, 2008; Meier-Augenstein, 2008), and DNA analysis (Dedouit, 2007).

Cause of death and demographic data

Among all the tasks carried out by the forensic anthropologist, one is to determine the cause of death. It is difficult for a medical examiner to determine the cause of death when the body becomes skeletonized and here begins the work of forensic anthropologists by examining the bones on the presence of diseases or traumas that led to the death (Schiwy-Bochat, 2004; Archer, 2005). One of the methods that have been used to establish a forensic context is the use of Fourier Transform Infrared Spectroscopy (FTIR), the method using crystallinity index and carbonate/phosphate index as markers of diagnosis (Nagy, 2008). The time elapsed since death has been determined using the insect evidence by examining the length and the size of the insect and by measuring a number of factors such as temperature, humidity, decomposition, adipocere formation and soil moisture (Pai, 2007).

The forensic anthropologist should also estimate the sex, ancestry, stature and age at death. Determination the sex is an important part of the identification process. In a study conducted on 50 crania from corpses Ramsthaler (2010) determined the sex by volume–rendered (CCT) images.

Estimation of sex, age, ancestry and stature in the skeletal remains has a long bone tradition in physical and forensic anthropology. Age estimation depends in part on the skeletal elements. In most forensic cases, sex would be unknown in the Juvenile especially pre – pubertal and adult skeleton. Any disturbance to normal growth patterns, such as, nutritional deficiency or chronic illness introduces a potential source in age estimation in Juveniles. In adults, the methods are the oscoxae (based on changes in the pubic symphyseal face and auricular surface), ribs, cranial sutures, hip and other methods like bone histology and amino acid racemization.

The measurement of mineral density may help in estimating the age at death and sex. Wheatley (2005) used Dual x-ray Absorptiometry (DEXA) to sexual bodyweight.

Determining sex and body weight is very important in forensic anthropology. Many authors took different approach to estimates sex and age like growth rate of illium, and some they chose nine discrete variables, such as, occipital protuberance, mastoid process, sub – pubic angle, ischiopubic ridge and preauricular sulcus, and another calculation of the cranial capacity, some forensic scientists with anthropologists used foot dimension and shoe size to estimate sex (Wheatley, 2005). Iscan (2005) examined the relationship between body height and the maximum femoral length. The body mass in

subadult human skeletons was estimated by Rutty (2003). There are two methods for estimating body mass in subadults the width of the distal femur metaphysic and the femoral head, the first method is useful in individual below 12 years old, and the second method is useful for older subadults. Determining the stature is an important factor to identify the human remains. When we take the measurement of long bones we should notice the limb asymmetry; asymmetry of the human body may result in erroneous estimate due to bilateral variations of human body and bones. In a study conducted on samples of 967 adult males, aged between 18 and 30 years, the result indicated that the bilateral asymmetry exists in upper extremity length, and explained that this people live in agricultural communities may have large asymmetries of the human body due to hard physical activity (Castillo, 2011). In a study conducted by Macaluso (2011) on a twentieth century skeletal samples from France using photogrammetry in order to develop osteometric standards for sex assessment. A more recent study determined the sex by using scapula metrics on New Kingdom skeletons from Tell El–Amarna. Sometimes human remains can reveal evidence of burning. In a study conducted by Charlier and colleagues on a group called Joan of Arc's relics, they used Fourier Transform Infrared Spectroscopy (FTIR) was

needed in order to determine if the human skeletal remains were carbonized (Charlier, 2010).

Some of the forensic studies reconstruct the face of the victims as an advanced method in forensic anthropology, for example, the known study that was conducted to reconstruct the face of poet Dante Alighiri by using virtual modeling. When dealing with mummies and mummified bodies, the virtual approach is very helpful. Based on these technologies, the reconstruction of the face of Farrante Gonzage, an Italian nobleman of the Renaissance period, was carried out by CT scanner and the 3D digital modeling, the reconstructed face was compared with two portraits of Ferranto Gonzage (Benazzi, 2010).

Forensic palynology is a useful tool in crime scene investigation. It is based on identifying pollens and spores at the crime scene, so it can determine the last place of victim. In a study conducted on human remains that were found in 1999 in alpine glacier in a remote part of Tatshenshini – Alsek part. This young adult male's body was recovered. The forensic anthropologist played an important role in the identification process by using pollen analysis. Pollen grains were determined to be most similar to the grains from stomach of the decayed and suggest that the ancient travelers of the last meal came from the coast rather that from Inland (Mathewes, 2006).

A study conducted by Palazzo (2009) identified the release of metals from osteosynthesis implants, metal structures especially of stainless steel, titanium and their alloys. This study presents the first experience into the presence of permanent tissue around metal implants in various bones for the identification.

The expertise of a forensic anthropologist includes the study of burned bodies. In a study conducted by Thompson on burned bodies, the results of the changes caused by heat on bone configuration were examined: color change, fracture patterns and dimension change. A study conducted by on burned human bones and tibiae bones of cows to determine the temperature on which the original configuration of the bone could be retained, at a temperature ranging from 600-700 ºC, amplifiable DNA material can be retrieved and at a temperature of 200 ºC stable isotope values of light elements remained unchanged (1000 ºC to strontium). Regarding the bone structure/configuration, between 150-300 ºC, the bone loses its chemical bound water and between 300-600 ºC, the color changes from brown to black to grey, finishing on white color (approximately at 800 ºC) reaching the complete combustion with the oxidation of the organic carbon (Thompson, 2004). The study by Falsetti (2002) analyzed elements in bones by proton – induced x – ray emission (PIXE). Their aim was to detect the

presence of metal residues and determine the location of the gun shot through measuring the body concentrations of lead in a specific place in the body to find the bullet's specific location. However, it is necessary to use forensic archaeology along with forensic anthropology because it facilitates the identification the remains.

Mummies

In a study conducted by Al-Shorman (2005) on a mummy from South Jordan, he used both visual and radiological examination to determine the cause of death. In a study by Shin (2003) on a mummy from medieval tomb in Korea, physical, radiological and dental examinations were made with the aim of determining the cause of the natural mummification of the body and determine the age at death. The study by Lee (2009) on the mummified remains found in Korea from the 17th century used computerized tomography to determine the cause of death and the manner of death. They found ante-mortem mandibular fracture demonstrated by the presence of blood clots. They also found feces in the sigmoid colon but not in stomach revealing that he has not eaten anything in two days before death. It was assumed that the cause of death was not due to the wasting or chronic disease, but rather a case of sudden death. In the study conducted by Sharp (2003) on archaeological hair samples from a mummy, they examined the

proportion of the element hydrogen in the hair to see the last place before death, because the hair retains 31% of hydrogen in the washing water.

A study was conducted on a group of Chinchorros of fisherman culture, who lived about 7000 years ago in coastal region of the Alacama Desert in the northern outpost of present day Chili. They practiced artificial mummification to their dead. There was a high proportion of arsenic in the bodies in the mummies and contemporary population, and this is due to the drinking water that is rich in arsenic as revealed by inductively coupled plasma – mass spectrometry (ICP–MS) (Byrne, 2010; Friedrich, 2010; Bartkus, 2011; Lee, 2007), applied a new technique in examining mummies that could virtually reconstruct the appearances of the internal organs without any damage. The technique is called the multi-detector computed tomography (MDCT). Accumulations of Ca/P were examined in hair of Taklamakan desert mummies for dating purposes. The accumulation has not been described to date in recent hairs in relation to known pathology or diet . In addition it is known that the climatic conditions play an important role in the preservation of bodies (Hallegot, 2008).

Isotopes analysis of tissues from six late prehistoric mummies in the central Andes was undertaken (bone collagen, muscle and skin). Bone collagen provides a record of paleodiet. They examine the proportion of a C^{12}/C^{13},

and the N^{15} to know the sources of plant or animal protein in diet, distinguishing marine from terrestrial proteins. The values of C^{13} in bone collagen from 6 individuals are consistent reliance upon maize as the primary dietary stable, suggesting that maize remained the foundation to subsistence economy to Andes (Finucane, 2007).

A study was conducted on strands of hair of 45 mummies of pre-Colombian children mummies to explore arsenic poisoning (5000 – 2000 years B.C) to the late intermediated period (1000 – 1400 years A.D) by using laser ablation inductively coupled plasma mass spectrometry (LA–ICP–MS). Osteological isotope evidence N^{15} and DNA typing analysis showed that the skeletons in multiple burials could be identified (Byrne, 2010).

The famous Korean child mummy that was wrapped by costumes, revealed significant results: the age of cotton samples was determined to be A.D 1360 ± 35 and the silk sample A.D 1530 ± 35. The cause of mummification in this case correlated with cultural aspects, not with natural condition, because it was found where the lime – soil barrier was maintained until discovery and which separated the inner space of the coffins from the outer space (Shin, 2003).

Hair analysis is commonly used in modern mummy research projects. A study was conducted on hair samples of eight pre-Columbian mummies to reveal the presence of cocaine, nicotine and cannabinoids using modern routine gas chromatographic – mass spectrometric technique (GC – MS), and radiocarbon dating. In three out of eight hair samples of pre – Colombian mummies, nicotine was found in an adult woman with a radiocarbon date of 1095 ± 50 A.D. A child mummy has a radiocarbon age of 1415 ± 16 A.D. Nicotine was measured in concentrations of 57.5 ng/mg, 14.1 ng/mg respectively (Musshoff, 2009).

In Frananco, a Russian expedition discovered a site of more than 10 frozen tombs in the central part of a Sakha. The tomb was dated by radiocarbon and dendrochronology to 14^{th}-19^{th} century AD. Multislice computed tomography (MSCT) was performed. Anthropological study aimed to make positive identification of mummy (determine six, age at death, stature, body mass and morphological affinity). The mummy was 19 years old female, the stature was 146 cm, and the body mass was estimated to be 49 kg. The manner of death followed a disseminated infection (Dedouit, 2010).

The skin from the leg of an Egyptian mummy was collected and prepared microtomy then analyzed using infrareds microscopy. In the external part of the skin protein can be observed in the deepest part of the skin and

adipocere, palmitic acid and calcium oxalate are identified in the skin of the mummy (Cotte, 2005).

Chang (2006) conducted as study on the hair taken from a 15th century mummy where he compared the results to the results from living individuals, he concluded that the hair of mummy showed very intact appearance even 500 years after burial; the presence of surface coat on the hair led to excellent preservation of 15th century mummified hair.

In most mummies' cases, the internal organs were found to have been displaced to the dorsal side of the body cavity caused by the effect of gravitation force exerted over long burial duration. The study that was conducted by Oh (2011) on two medieval Korean mummies used CT computerized tomography images and post-factum dissections. The internal organs were not displaced to dorsal but remained in their natural position that might have been hindered by the presence of a pleural adhesion.

CHAPTER

Three

Chapter Three

Results:-

Case 1:- 27 \ 2011

This case was brought to NIFM by Al-Naser Police Station on 3\1\2011 and remained to be investigated until the beginning of this study. The cranium shows multiple fractures, the broken parts were reconstructed using cotton and threads. There are surface exfoliation in the parietal and frontal bones, there are radiating fractures in the right parietal bone. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994). Table 1 below shows the inventory.



Fig. 1:- Superior view of cranium, case 1 \ 27 \ 2011.



Fig. 2:- The radiating fractures showed in the right parietal, case 1 \ 27 \ 2011.

Bone inventory:-

Table 1:- The inventory of long bones of case 1 \ 27 \ 2011.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Left	Intact	100%	Complete
Humerus	Right	Intact	100%	Complete
Humerus	Left	Broken	80%	Complete
Radius	Right	Intact	100%	Complete
Radius	Left	Intact	100%	Complete

Ulna	Right	Intact	100%	Complete
Femur	Right	Intact	100%	Complete



Fig. 3:- Long bones (Femur, right and humerus, right ulna, right and radius), case 1 \ 27 \ 2011.

Table 2: The inventory of the remaining bones of case 1 \ 27 \ 2011.

Bone	Side	Preservation	Fusion
Cranium		Fragments	Complete
Maxilla		Broken	Complete
Scapula	Right	Broken	Complete
Illium	Right	Broken	Complete
Illium	Left	Broken	Complete
Ischium	Right	Broken	Complete
Metacarpals	Right	Intact	Complete
Metacarpals	Left	Intact	Complete



Fig. 4:- The fragments of cranium, case 1 \ 27 \ 2011.



Fig. 5:- The body of sternum, case 1 \ 27 \ 2011.



Fig. 6:- Dorsal view of scapula, case 1 \ 27 \ 2011.

Table 3: The inventory of the vertebrae of case 1 \ 27 \ 2011.

Vertebrae	Type	Preservation	Fusion
Cervical (1 – 7)	1 - 6	Broken	Complete
Thoracic (8 – 12)	8 – 12	Broken	Complete
Lumbar (13 – 17)	13 - 16	Broken	Complete



Fig. 7:- The vertebrae, case 1 \ 27 \ 2011.

Table 4: The inventory of the ribs of case 1 \ 27 \ 2011.

Ribs	Side	Preservation
Rib 1	Left	Intact
Ribs (3 – 7)	Right	Fragments
Ribs (3 – 7)	Left	Fragments
Ribs (8 – 10)	Right	Fragments
Ribs (8 – 10)	Left	Fragments
Ribs (11 – 12)	Right	Fragments
Ribs (11 – 12)	Left	Fragments



Fig. 8:- Rib and rib fragment, case 1 \ 27 \ 2011.

Table 5: Dental inventory, case 1 \ 27 \ 2011.

Tooth type	Side
UI2	Left
UC	Right
UC	Left
LC	Right
LC	Left
UPM1	Left
UPM2	Right
LPM2	Right
UM1	Right
UM1	Left

LM1	Right
UM2	Right



Fig. 9:- Anterior view of the maxilla, case 1 \ 27 \ 2011.



Fig. 10:- Teeth, case 1 \ 27 \ 2011.



Fig. 11:- Skeletal recording of bones, case 1 \ 27 \ 2011

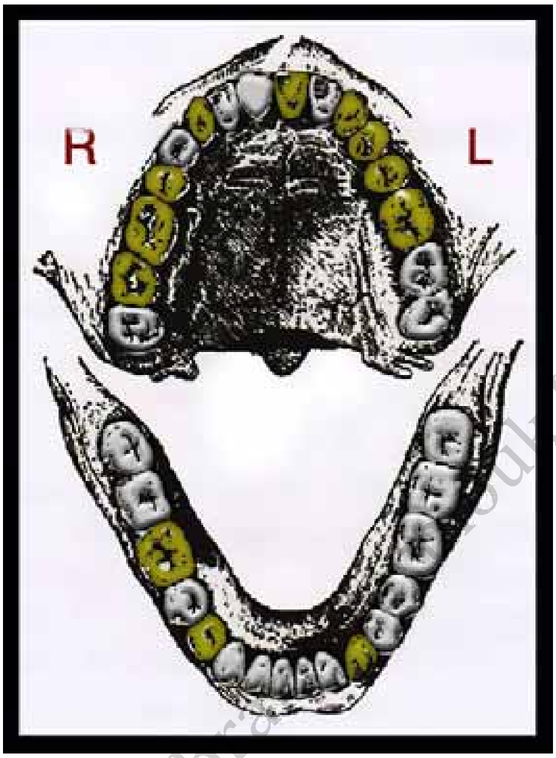


Fig 12:- Dental recording, case 1 \ 27 \ 2011

According to figures 11 and 12, there are missing bones and teeth, probably after death. This indicates postmortem transfer and or damage to the skeleton as the fractures were not premortem, except for the radiating fracture in the skull missing bones also accrue in cases where the forensic anthropologist is not present at the time of bone recovery.

Sex estimation:-

Tables 6 and 7 show the result of sex estimation of case number 1/27\2011 using a decision chart.

Trait	Males	Female
Size	Large and rugged	**<u>Small and smooth</u>**
Mastoid	Large , projecting	**<u>small , no projecting</u>**

Table 6:- The morphological features of the skull of case 1\27\2011.



Fig.13:- Left lateral view of cranium, case 1 \ 27 \ 2011.

Trait	Male	Female
Size	Large and rugged	**<u>Small and gracile</u>**

Ilium	High and vertical	**Low and flat**
Subpubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and triangular**
Greater sciatic notch	Narrow	**Wide**

Table 7:- The morphological features of the pelvis in case 1/27/2011.



Fig. 14:- Lateral view of the right the pelvis, case 1 \ 27 \ 2011.

According to tables 6 and 7, the sex of the case is mostly female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 8 shows the result of ancestry of case number 1/27/2011.

Structure	**Whites**	**Blacks**	**Asians**
Vault			
Muscle marks	**Rugged**	Smooth	Smooth
Vault sutures	**Simple**	**Simple**	Complex
Jaws and teeth			
Jaws	**Small**	Large	Large
Palatal shape	**Parabolic**	Hyperbolic	Elliptical
	Speculate	**Speculate**	Shoveled

Table 8:- The morphological features of the vault and jaws of case 1/27\2011.



Fig. 15:- Anterior view of the cranium, case 1 \ 27 \ 2011.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white female.

Humerus = 30 cm

ST = 3.36 * (30) + 57.97, SE = 4.45

= 158.77

= 158.77 ± (4.45 * 2)

= 158.77 ± 8.9

= (149.87 - 167.67) cm

Radius = 24 cm

ST = 4.74 * (24) + 54.93, SE = 4.24

= 168.69

= 168.69 ± (4.24 * 2)

= 168.69 ± 8.48

= (160.21 - 177.16) cm

Ulna = 26.6 cm

ST = 4.27 * (26.6) + 57.76, SE = 4.30

= 171.34

= 171.34 ± (4.30 * 2)

= 171.34 ± 8.6

= (162.74 - 179.94) cm

Femur = 46 cm

ST = 2.47 * (46) + 54.74, SE = 3.72

= 168.36

= 168.36 ± (3.72 * 2)

= 168.36 ± 7.44

= (160.92 - 175.8) cm

According to the range chart, the stature of this case is (160.92 – 167.67 cm) (Fig. 16).

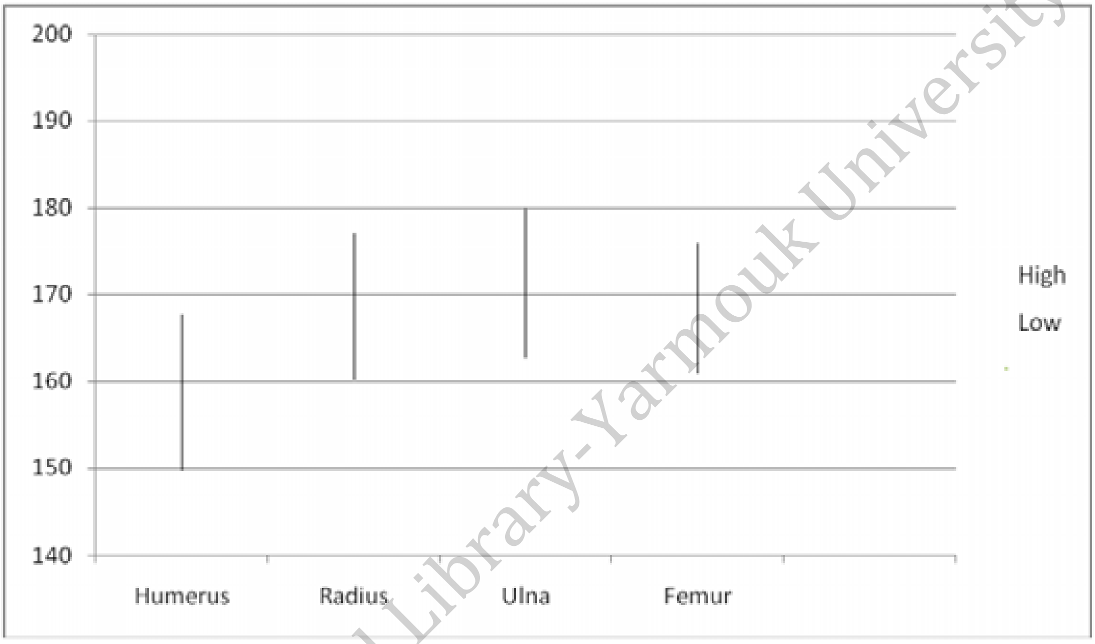


Fig. 16:- Range chart of stature from long bones; case 1 \ 27 \ 2011.

Age estimation:-

1. The fusion of clavicle starts at the age of 27years old and may continue to the age of 32 years old, and the clavicle bone of this case is fused.
2. Also the third molar usually erupts at the age of 18 years old, it is fully erupted in the case.

Based on these information and using the range chart, the estimated age is above 27 years old (Fig. 17). The age could not be estimated using the cranial statures because the cranium is not complete.

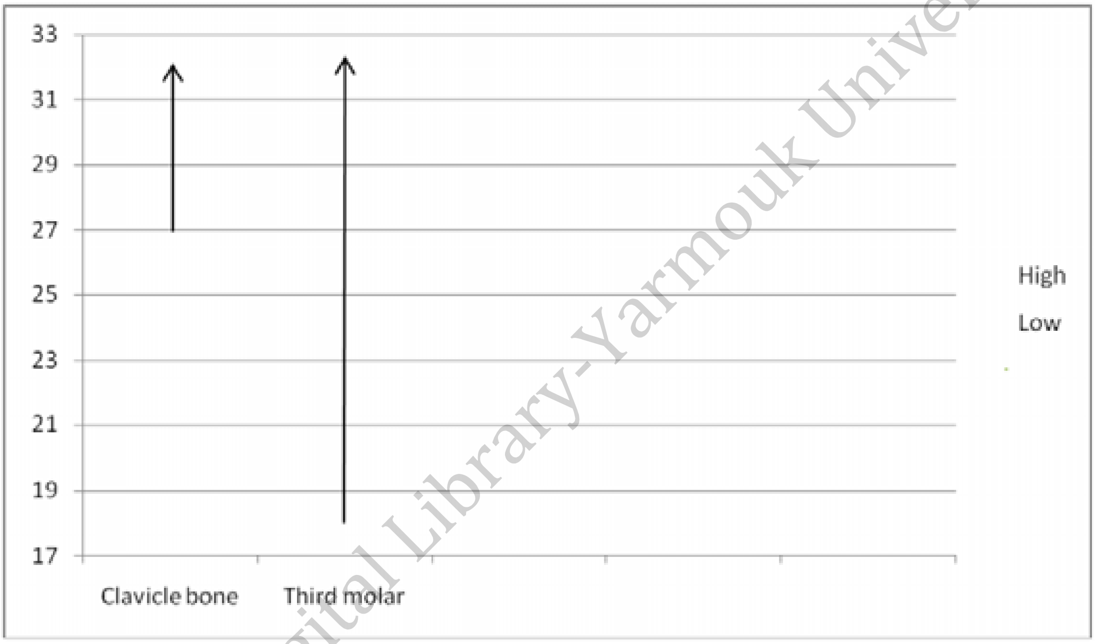


Fig. 17:- Range chart of age at death from the third molar and the clavicle bone; case 1 \ 27 \ 2011.

Time elapsed since death (TESD): -

The full skeletoization is usually reached within a period from 3 months to over 3 years, and in cold and dry areas from 2 months to 8 years. Accordingly the time elapsed since death is more than a month. The skeleton is mostly recent (not archaeological), because no archaeological context is reported by the police. No associated materials were recovered along with

the bones that can be detected. Also, the bones lack a geographical context. According to Byeres (2002), the TESD is reached from 3 months to over 3 years .

Cause of death: -

This type of injury might be caused by a blunt trauma. Head injury is mostly premortem because the line of fracture is not rugged and the fractures are exhibited as radiating lines.



Fig. 18:- Lateral view of the cranium, case 1 \ 27 \ 2011.

Manner of death: -

Unknown.

Summary: -

The case belongs to a white female measuring about 165 cm in height. She died at an age of more than 27 years old due to a blunt trauma to the side of

the head. The time elapsed since death is probably more than 2 months. The bones in this case are healthy, where no pathological or congenital lesions could be seen; positive identification could not be reached in part due to the absence of premortem data from police departments and medical records and to the absence of associated materials.

The time elapsed since death has a very wide range that is not helpful even in the presence of antemortem records, so we stress on the presence of a forensic anthropologist at the crime scene to collect evidence as much as possible. According to the bone and teeth inventories, the number of individuals in the case is one.

Case 2:- 2681

Group of bones from South - Shounah.

This case was brought to NIFM on 16\10\2008 and remained to be investigated. The bones were found on 15 \ 10 \ 2008 in a grave in South - Shounah, with roots of plant. The bones show cracking, flecking, long bones shown longitudnal cracks suggesting sun exposure for a long period of time.



Fig. 19:- Longitudinal cracks in fibula resulting from sun exposure, case 2 \ 2681 South - Shounah.



Fig. 20:- Superior view of cranium, case 2 \ 2681 South - Shounah.

Bone inventory:-

Table 9:- The inventory of long bones of case 2 \ 2681 South - Shounah.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Left	Broken	80%	
Humerus	Right	surface erosion , there are septal	90%	Not fused

		aperture into the olecranon fossa		
Humerus	Left	surface erosion , there are septal aperture into the olecranon fossa	90%	Not fused
Radius	Right	surface erosion	100%	Not fused
Radius	Left	surface erosion	100%	Not fused
Ulna	Right	surface erosion	100%	Not fused
Ulna	Left	surface erosion	100%	Not fused
Femur	Left	surface erosion	20%	Not fused
Fibula	Left	surface erosion and warping	100%	Not fused
Tibia	Right	surface erosion	20%	Complete



Fig. 21:- Long bones (femur, right distal tibia, right and humerus, fibula, right and radius and right and ulna), there are septal aperture in olecranon fossa and the fibula warping, all of long bone without tibia not fused, case 2 \ 2681 South - Shounah.



Fig. 22:- Anterior view of lift clavicle bone, case 2 \ 2681 South - Shounah.

Table 10: The inventory of the remaining bones of case 2 \ 2681 South - Shounah.

Bone	Side	Preservation	Fusion
Skull		Fracture in right temporal and surface erosion	Complete
Maxilla		Surface erosion	Complete
Scapula	Right	Broken	
Illium	Right	Broken	Not fused
Illium	Left	Broken	Not fused
Ischium	Right	Broken	Not fused
Ischium	Left	Broken	Not fused
Pubis	Right	Broken	Not fused
Pubis	Left	Broken	Not fused



Fig. 23:- Anterior view of the scapula, case 2 \ 2681 South - Shounah.

Table 11: The inventory of the vertebrae, case 2 \ 2681 South - Shounah.

Vertebrae	Type	Preservation	Fusion
Cervical (1 – 7)	1 - 7	Broken	Complete
Thoracic (8 – 12)	8 – 9	Broken	Complete
Lumbar (13 – 17)	13 - 17	Broken	Complete



Fig. 24:- Inferior view of vertebrae column, case 2 \ 2681 South - Shounah.

Table 12: The inventory of the ribs, case 2 \ 2681 South - Shounah.

Ribs	Side	Preservation
Rib 2	Left	Surface erosion
Ribs (3 – 5)	Right	Broken
Ribs (6 – 7)	Left	Broken
Ribs 10	Right	Broken
Ribs 12	Left	Broken



Fig. 25:- The ribs, case 2 \ 2681 South - Shounah.

Table 13: Dental inventory, case 2 \ 2681 South - Shounah.

Tooth type	**Side**
UPM2	Right
UPM1	Left
UPM2	Left
UM1	Right
UM1	Left
UM2	Right
UM2	Left
LPM1	Left



Fig. 26:- Inferior view of the maxilla, case 2 \ 2681 South - Shounah.



Fig. 27:- Skeletal recording of bones, case 2 \ 2681 South - Shounah.

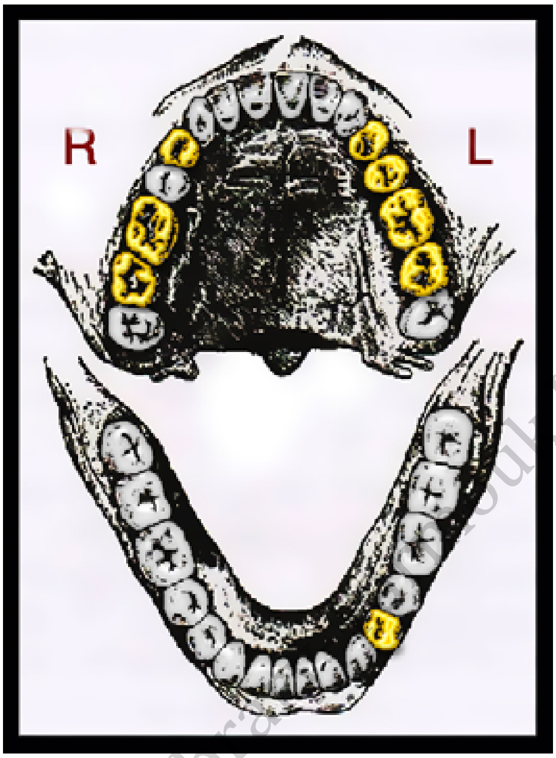


Fig. 28:- Dental recording, case 2 \ 2681 South - Shounah.

According to figures 27 and 28, some bones were missing.

Sex estimation:-

Tables 14 and 15 show the result of sex estimation of case number 3 \ 2681 South - Shounah, using a decision chart.

Trait	Males	Female
Size	Large and rugged	**Small and smooth**
Mastoid	Large , projecting	**small , no projecting**
Brow ridges	Large	**Small , None**
Frontal	Slanted	**High , Rounded**
Nucal area	Rugged with hook	**Smooth , hook unknown**
Supraorbital margin	Rounded	**sharp**

Table 14:- The morphology features of the skull of case 2 \ 2681 South - Shounah.



Fig. 29:- Lateral view of cranium, case 2 \ 2681 South - Shounah.

Trait	Male	Female
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pelvic inlent	Heart shaped	**Circular or elliptical**
Pubic shape	Narrow and rectangular	**Broad and square**
Subpubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and triangular**
Greater sciatic notch	Narrow	**Wide**

Preauricular sulcus	Rare	**Well developed**
Shaped of sacrum	Long and narrow	**Short and broad**

Table 15:- The morphology features of the pelvis of case 2 \ 2681 South - Shounah.



Fig. 30:- Dorsal view of pelvis, case 2 \ 2681 South - Shounah.

According to tables 14 and 15, the sex of the case is mostly female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 16 shows the result of ancestry of case number 3 \ 2681 South - Shounah.

Structure	whites	Blacks	Asians
Nose Root	**High , Narrow**	Low , Rounded	Low , Ridged

Bridge	**High**	Low	Low
Lower border	**Shape (sill)**	Guttered	Flat , Sharp
Spine	**Pronounced**	Small	Small
Width	**Narrow**	Wide	Medium
Face			
Profile	**Straight**	Projecting	Intermediate
Sharp	**Narrow**	Narrow	Wide
Eye orbits	**Angular**	Rectangular	Rounded
Lower eye border	**Receding**	Receding	Projecting
Vault			
Brow ridges	Heavy	**Small**	**Small**
Muscle marks	**Rugged**	Smooth	Smooth
Vault sutures	**Simple**	**Simple**	Complex
Postbregma	Straight	**Depressed**	Straight
Jaws and teeth			
Jaws	**Small**	Large	Large
Palatal shape	**Parabolic**	Hyperbolic	Elliptical
Upper incisors	**Spatulate**	**Spatulate**	Shoveled

Table 16:- The morphological features of the vault and jaws for case number 2 \ 2681 South - Shounah.



Fig. 31:- Anterior view of the cranium, case 2 \ 2681 South - Shounah.



Fig. 32:-Posterior view of the cranium case 2 \ 2681 South - Shounah.



Fig. 33:- Inferior view of cranium, case 2 \ 2681 South - Shounah.

Stature estimation was not performed because the long bones were not fused.

Age estimation:-

1. Bone fusion: - humerus epiphisis is not fused (10 – 12 years old).
2. |The third molar tooth was not erupted (12 – 15 years old).
3. Auricular surface (19 – 23 years old). Marked billowing over surface, cortical bone on surface has fine-grained texture, smooth-edged youthful defects near apex, no retroauricular activity and no apical activity.

Based on this information and using the range chart, the estimated age is from 10- 12 years old (Fig. 54). The arrange from auricular surface not reliable in this case because the age is very young.



Fig 34:- Right humerus, case 2 \ 2681 South - Shounah.



Fig 35:- Lateral view of the pelvis, case 2 \ 2681 South - Shounah.



Fig 36:- The auricular surface, case 2 \ 2681 South - Shounah.

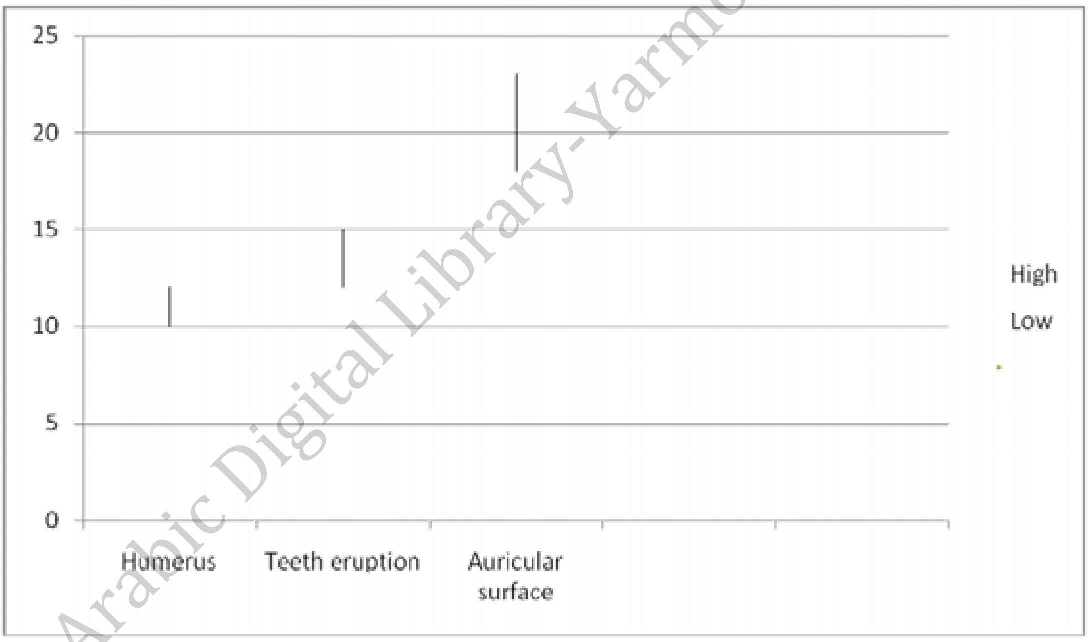


Fig 37:- Range chart of age at death from humerus, auricular surface, and teeth eruption, case 2 \ 2681 South - Shounah.

Time elapsed since death (TESD): -

This case was found in October in South - Shounah, this area is warm and moist in this time of the year. So the time elapsed since death is more than 10 months.

Cause of death: -

Blunt trauma in right temporal causes the death, and the healed fracture in right parietal was long time before death, the line of fracture is rugged , the fracture show radiating lines and the color of fracture is not lighter than the other bone.



Fig. 38:- Right lateral view of cranium, case 2 \ 2681 South - Shounah.

Manner of death: -

Unknown.

Summary:-

The case belongs to a white female. She died at about an age of 10-12 years old, due to a blunt trauma to the right side of the head. The time elapsed since death is probably more than 10 months. The skeleton remained exposed for a very long period of time. Unfortunately, no associated materials were reported by the police upon recovery. In addition the crime location is not archaeological. Positive identification was not performed because the author did not have antemortem recodes to compare with. Radiocarbon dating is needed to establish the forensic context.



Fig. 39:- X- ray of cranium, case 2 \ 2681 South - Shounah.



Fig. 40:- X – ray of lift fibula, case 2 \ 2681 South - Shounah.

Case 3:- 3284 \ 2011

Skeletal remains from Northern Badia.

This case was brought to NIFM on 21\11\2011 and remained to be investigated, they found these bones on 21 \ 11 \ 2011 in a cave in the Anezh – wadi almaleh – (north safawi) in the northern Badia, with a piece of cloth and chicken feathers. This case found without skull, the vertebral column and second and third (carpal, metacarpal and phalanges) found connected, there are desiccated tissue in bones, all of the bones were fused, the femur, radius and scapula were broken postmortem.



Fig. 41:- Inferior view of right carpal, Meta carpal and phalang bones, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.



Fig. 42:- Inferior view of tibia articular surface, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.



Fig. 43:- Inferior view of a lumbar vertebrae, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.



Fig. 44:- Lateral view of ribs with desiccated tissues; case 3 \ 3284 \ 2011 skeletal remains from northern Badia.



Fig. 45:- Posterior view of femur, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.



Fig. 46:- Anterior view of the radius, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Bone inventory:-

Table 17:- The inventory of long bones of case 4 \ 3284 \ 2011 skeletal remains from northern Badia.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Right	Intact with desiccated tissue	100%	Complete
Clavicle	Left	Intact with desiccated tissue	100%	Complete
Humerus	Right	Desiccated tissue in head, trochlea and capitulum	100%	Complete
Humerus	Left	Desiccated tissue in head, trochlea and capitulum	100%	Complete
Radius	Right	Broken	100%	Complete

Ulna	Right	Intact	100%	Complete
Femur	Right	Broken, there are desiccated tissue	90%	
Femur	Left	Broken, there are desiccated tissue	65%	Complete
Fibula	Right	There are desiccated tissue	100%	Complete
Fibula	Left	There are desiccated tissue	100%	Complete
Tibia	Right	Intact	100%	Complete



Fig. 47:- Anterior view of long bones (right and femur, right and fibula, right tibia, right and lift humerus, right radius, right ulna) , case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Table 18: The inventory of the remaining bones of case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Bone	Side	Preservation	Fusion
Scapula	Right	Desiccated tissue in glenoid cavity	Complete
Scapula	Left	Broken, desiccated tissue in glenoid cavity	Complete
Illium	Left	Broken, there are desiccated tissue	Complete
Ischium	Left	There are desiccated tissue	Complete
Pubis	Left	Broken, there are desiccated tissue	Complete
sacrum		Intact , there are desiccated tissue	Complete
Metacarpals	Right	Second and third connected, there are	Complete

		desiccated tissue	



Fig. 48:- Anterior view of scapulae, case 3 \ 3284 \ 2011 Skeletal remains northern Badia.

Table 19: The inventory of vertebrae, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Vertebrae	**Type**	**Preservation**	**Fusion**
Cervical (1 – 7)	4 - 7	Intact and connected	Complete
Thoracic (8 – 12)	8 – 12	Intact and connected	Complete
Lumbar (13 – 17)	13 - 17	Intact and connected	Complete



Fig. 49:- Posterior view of vertebrae column, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Table 20: The inventory of the ribs, case 4 \ 3284 \ 2011 skeletal remains northern Badia.

Ribs	Side	Preservation
Rib 1	Right	Intact
Rib 2	Left	Intact
Ribs (3 – 7)	Right	Broken with desiccated tissue
Ribs (3 – 7)	Left	Broken with desiccated tissue
Ribs (8 – 10)	Right	Broken with desiccated tissue
Ribs (8 – 10)	Left	Broken with desiccated tissue
Ribs (11 – 12)	Right	Broken with desiccated tissue
Ribs (11 – 12)	Left	Broken with desiccated tissue



Fig. 50:- The ribs, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

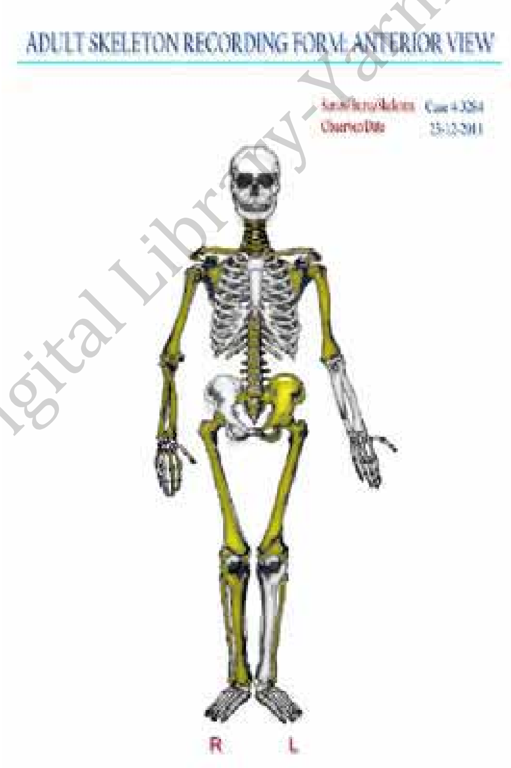


Fig. 51:- Skeletal recording of bones, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

According to figure 51, some bones were missing. These bones were probably on the surface at that time, or probably the site was not excavated properly.

Sex estimation:-

Table 21 shows the result of sex estimation of case number 3 \ 3284 \ 2011 skeletal remains from northern Badia, using a decision chart.

Trait	Male	Female
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pelvic inlent	Heart shaped	**Circler or elliptical**
Pubic shape	**Narrow and rectangular**	Broad and square
Sub pubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and triangular**
Greater sciatic notch	Narrow	**Wide**
Shaped of sacrum	Long and narrow	**Short and broad**

Table 21:- The morphology features of the pelvis for case 3 \ 3284 \ 2011 skeletal remains from northern Badia.



Fig. 52:- Medial view of pelvis, broken ischium, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

According to table 21, the sex of the case is mostly female.



Fig. 53:- Superior view of the head of humerus, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white female.

Humerus = 28.9 cm

ST = 3.36 * (28.9) + 57.97, SE = 4.45

= 155.07

= 155.07 ± (4.45 * 2)

= 155.07 ± 8.9

= (160.21 - 163.97) cm

Ulna = 23.2 cm

ST = 4.27 * (23.2) + 57.76, SE = 4.30

= 156.82

= 156. 82 ± (4.30 * 2)

= 156. 82 ± 8.6

= (148.22 - 165.42) cm

Tibia = 34.1 cm

ST = 2.90 * (34.1) + 59.24, SE = 3.66

= 158.13

= 158.13 ± (3.66 * 2)

= 158.13 ± 7.32

= (150.81 - 165.45) cm

Fibula = 33.7 cm

ST = 2.93 * (33.7) + 59.61, SE = 3.57

= 158.35

= 158.35 ± (3. 57 * 2)

= 158.35 ± 7.14

= (151.21 - 165.45) cm

According to the range chart, the stature of this case is (160.21 – 163.97 cm) (Fig. 54).

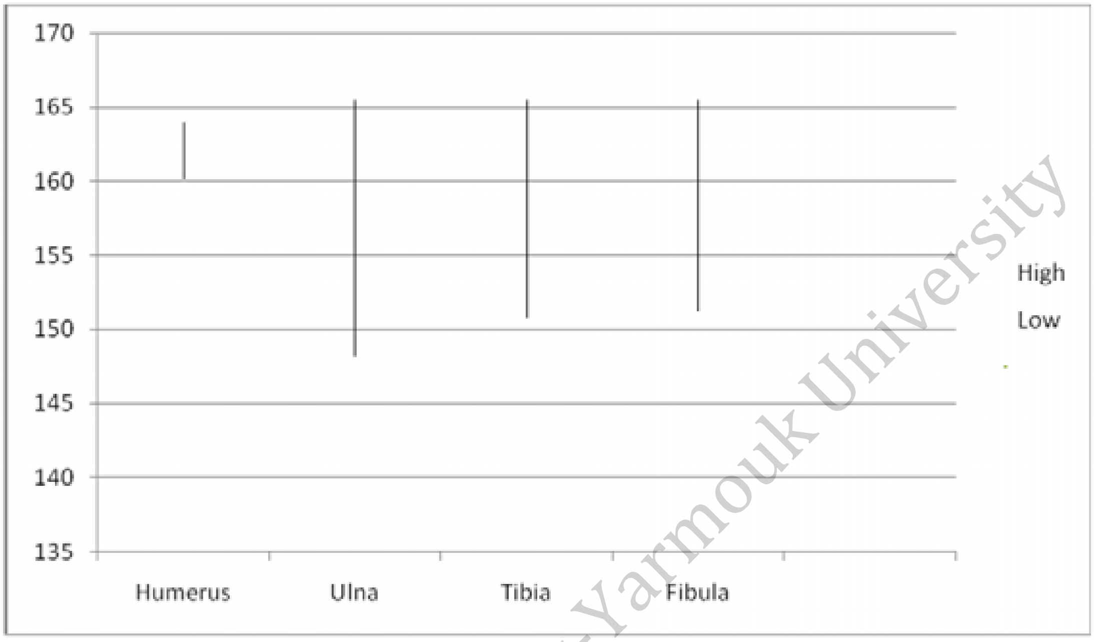


Fig. 54:- Range chart of stature from long bone, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Age estimation:-

1. The fusion of clavicle starts at the age of 27 and may continue to the age of 32 years old, the clavicle in this case is fused.
2. Auricular surface (19 – 23 years old). Marked billowing over surface, cortical bone on surface has fine-grained texture, smooth-edged youthful defects near apex, no retroauricular activity and no apical activity.
3. Humerus fused above 16 years.

Based on this information and using the range chart, the estimated age is about (19 – 23 years old) (Fig. 56).



Fig. 55- Lateral views of the pelvis, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

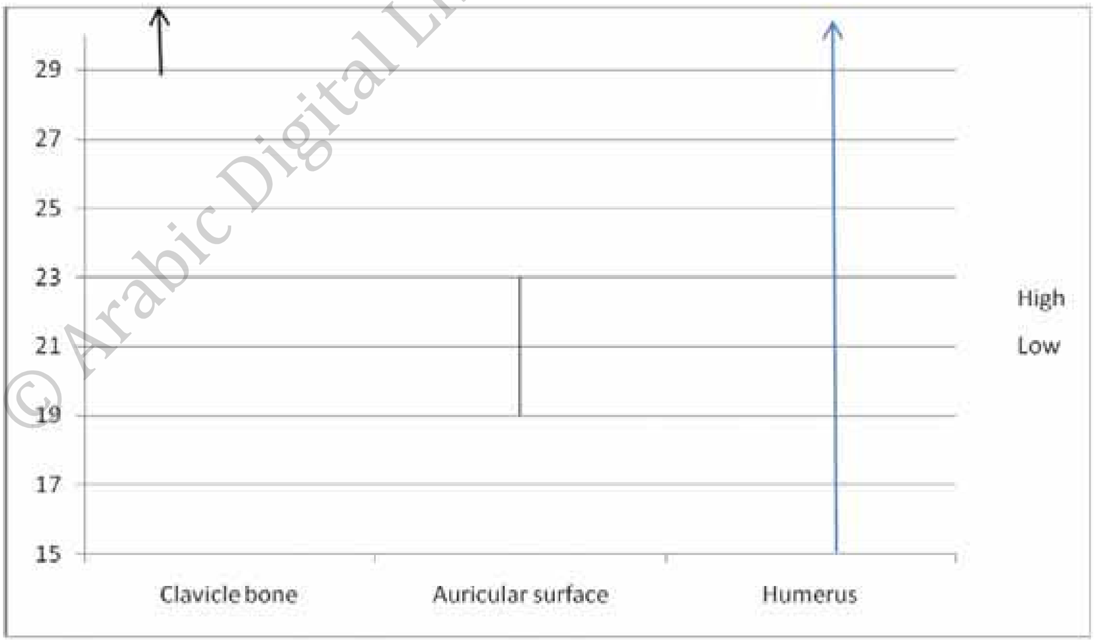


Fig. 56:- Range chart of age at death from clavicle bone, auricular surface, and fused humerus, case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Time elapsed since death (TESD):-

The climate conditions in northern Badia usually preserve corpses for long time. In addition, cares maintain stable temperature all over the years, which delayed decomposition. Such environments may delay skletonization to more than 3.5 years. The presence of desiccated tissues indicates that the time elapsed since death is less than 3.5 years. The presence of cotton (identifiable) indicates a TESD between 2- 10 months, but increased in case of cave burials. It is substantial then that the range for TESD for this case is between 1 – 3.5 years.



Fig. 57:- A piece of cloth (jeans), case 3 \ 3284 \ 2011 skeletal remains from northern Badia.

Cause of death:-

Unknown.

Manner of death: -

Unknown.

Summary:-

The case belongs to a female measuring between (160.21 – 163.97 cm) in height. She died at about an age of 19 – 23 years old. The time elapsed since death is probably from 1 – 3.5 years. The location of the burial (north Badia) preserve the body for years after death. The body is recent, so there is not need to perform radiocarbon dating. Positive identification is not performed as there were no antemortem records. The absence of the skull along with the first three cervical vertebrae may indicate capitation at the time of the death (before decomposition took place).

Case 4:- 1955

Skeletal remains from Northern Badia.

This case was brought to NIFM from northern Badia and remained to be investigated until the beginning of this study. The cranium shows multiple fractures, the broken parts were reconstructed using threads. The fractures in cranium were postmortem and antemortem as well. A denture was found with the bones. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994). Table 1 below shows the inventory.



Fig. 58:- Fragment of the skull with a denture, case 4 \ 1955 northern Badia.

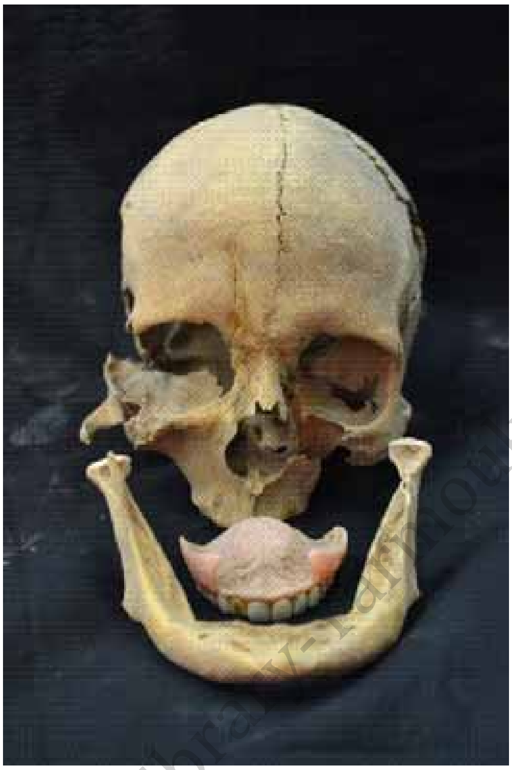


Fig. 59:- Anterior view of the cranium, mandible and denture, case 4 \ 1955 northern Badia.

Bone inventory:-

Table 22:- The inventory of long bones of case 5 \ 1955 northern Badia.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Right	Intact	100%	Complete
Clavicle	Left	Intact	100%	Complete
Humerus	Right	Intact	100%	Complete

Humerus	Left	Broken	90%	Complete
Radius	Right	Intact	100%	Complete
Radius	Left	Intact	100%	Complete
Ulna	Right	Intact	100%	Complete
Ulna	Left	Intact	100%	Complete
Femur	Right	Intact	100%	Complete
Femur	Left	Intact	100%	Complete
Fibula	Right	broken	90%	Complete
Fibula	Left	Intact	100%	Complete
Tibia	Right	Intact	100%	Complete
Tibia	Left	Intact	100%	Complete



Fig. 60:- Long bones (Right and femur, right and tibia, right and fibula, right and humerus, right and ulna, right and radius), case 4 \ 1955 northern Badia.

Table 23: The inventory of the remaining bones of case 4 \ 1955 northern Badia.

Bone	Side	Preservation	Fusion
Skull		Fragments	Complete
Maxilla		Broken	Complete
Mandible		Intact	Complete
Sternum		Intact	Complete
Scapula	Right	Broken	Complete
Scapula	Left	Broken	
Illium	Right	Intact	Complete

Illium	Left	Broken	Complete
Ischium	Right	Intact	Complete
Ischium	Left	Broken	Complete
Pubis	Right	Broken	Complete
Sacrum		Broken	Complete
Metacarpals	Right	Intact	Complete
Metacarpals	Left	Intact	Complete
Metatarsals	Right	Intact	Complete
Metatarsals	Left	Intact	Complete



Fig. 61:- The scapulae, case 4 \ 1955 northern Badia.

Table 24: The inventory of the vertebrae, case 4 \ 1955 northern Badia.

Vertebrae	Type	Preservation	Fusion
Cervical (1 – 7)	1 - 7	Broken	Complete
Thoracic (8 – 12)	8 – 12	Broken	Complete
Lumbar (13 – 17)	13 - 17	Broken	Complete



Fig. 62:- The vertebrae, case 4 \ 1955 northern Badia.

Table 25: The inventory of the ribs, case 4 \ 1955 northern Badia.

Ribs	Side	Preservation
Rib 1	Right	Broken
Rib 1	Left	Broken
Rib 2	Right	Broken
Rib 2	Left	Broken
Ribs (3 – 7)	Right	Broken
Ribs (3 – 7)	Left	Broken

Ribs (8 – 10)	Right	Broken
Ribs (8 – 10)	Left	Broken
Ribs (11 – 12)	Right	Broken
Ribs (11 – 12)	Left	Broken



Fig. 63:- The ribs, case 4 \ 1955 northern Badia

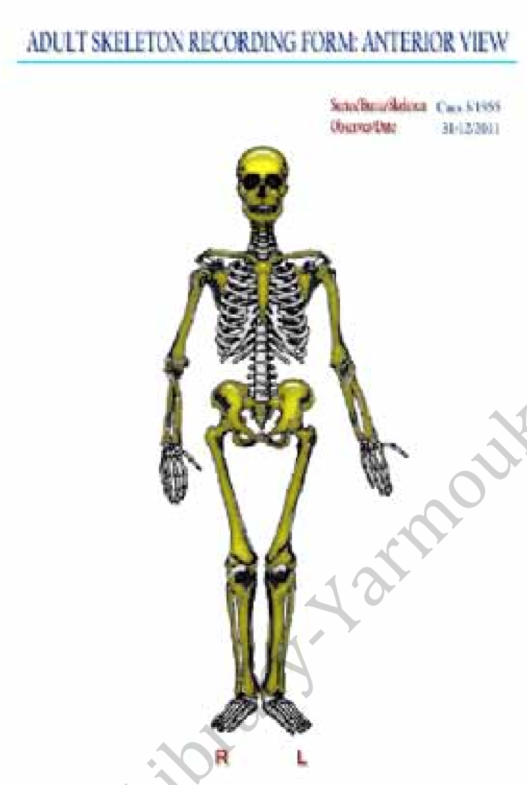


Fig. 64:- Skeletal recording of bones, case 4 \ 1955 northern Badia.

According to figure 64, some bones were missing. These bones were probably on the surface at that time, or probably the site was not excavated properly.

Sex estimation:-

Tables 26 and 27 show the result of sex estimation of case number 4 \ 1955 Northern Badia using a decision chart.

Trait	Males	Female
Size	Large and rugged	**Small and smooth**
Mastoid	Large , projecting	**small, no projecting**
Brow ridges	Large	**Small, none**
Frontal	Slanted	**High, rounded**
Nucal area	Rugged with hook	**Small, hook uncommon**
Supraorbital margin	Rounded	**Sharp**

Table 26:- The morphological features of the skull of case 4 \ 1955 northern Badia.



Fig. 65:- Anterio lateral view of cranium, case 4 \ 1955 northern Badia.

Trait	Male	Female
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Subpubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and triangular**
Greater sciatic notch	Narrow	**Wide**

Shaped of sacrum	Long and narrow	**Short and broad**

Table 27:- The morphological features of the pelvis in case 4 \ 1955 northern Badia.

According to table 34 and 35 above the sex of the skeleton was female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white.

Table 28 shows the result of ancestry of case number 4 \ 1955 northern Badia.

Structure	whites	Blacks	Asians
Nose			
Root	**High , Narrow**	Low , Rounded	Low , Ridged
Bridge	**High**	Low	Low
Lower border	**Shape (sill)**	Guttered	Flat , Sharp
Spine	**Pronounced**	Small	Small
Width	Narrow	Wide	Medium
Face			
Profile	Straight	Projecting	Intermediate
Sharp	Narrow	Narrow	Wide

Eye orbits Lower eye border	**Angular** **Receding**	Rectangular Receding	Rounded Projecting
Jaws and teeth Jaws Palatal shape Upper incisors	 **Small** **Parabolic** Speculate	 Large Hyperbolic Speculate	 Large Elliptical Shoveled

Table 28:- The morphological features of the vault and jaws for case number 4 \ 1955 northern Badia.



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Fig. 66:- Anterior view of the cranium, case 4 \ 1955 northern Badia.



Fig. 67:- Superior view of the cranium, case 45 \ 1955 northern Badia.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white female.

Radius = 22.1 cm

ST = 4.74 * (22.1) + 54.93, SE = 4.24

= 159.68

= 159.68 ± (4.24 * 2)

= 159.68 ± 8.48

= (151.12 - 168.16) cm

Ulna = 23.2 cm

ST = 4.27 * (23.2) + 57.76, SE = 4.30

= 156.82

= 156.82 ± (4.30 * 2)

= 156.82 ± 8.6

= (148.22 - 165.42) cm

Femur = 39.6cm

ST = 2.47 * (39.6) + 54.74, SE = 3.72

= 152.55

= 152.55 ± (3.72 * 2)

= 152.55 ± 7.44

= (145.11 - 159.99) cm

Tibia = 33.5 cm

ST = 2.90 * (33.5) + 59.24, SE = 3.66

= 156.39

= 156.39 ± (3.66 * 2)

= 156.39 ± 7.32

= (149.07 - 163.71) cm

Fibula = 32.5 cm

ST = 2.93 * (32.5) + 59.61, SE = 3.57

= 154.83

= 154.83 ± (3. 57 * 2)

= 154.83 ± 7.14

= (147.69 - 161.97) cm

According to the range chart, the stature of this case is (151.12 – 161.97 cm) (Fig. 68).

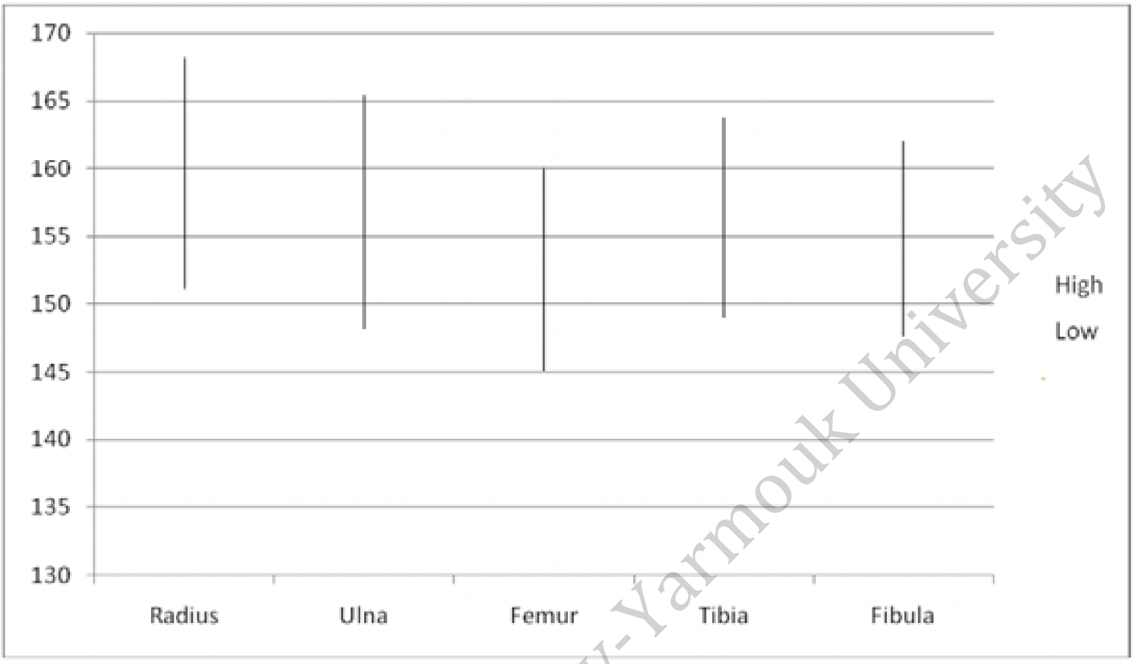


Fig. 68:- Range chart of stature from long bone, case 4 \ 1955 northern Badia.

Age estimation:-

1. The fusion of clavicle starts at the age of 27 and may continue to the age of 32 years old, the clavicle is fused.

2. Auricular surface (54 – 58 years old). No transverse organization, dense bone covering entire surface, surface rugged and strongly irregular, microporosity and macroporosity present, moderate retrouricular activity, moderate apical activity.

3. Humerus fused in age above 16 years old.

Based on this information and using the range chart, the estimated age is almost (54 – 58 years old) (Fig.69).

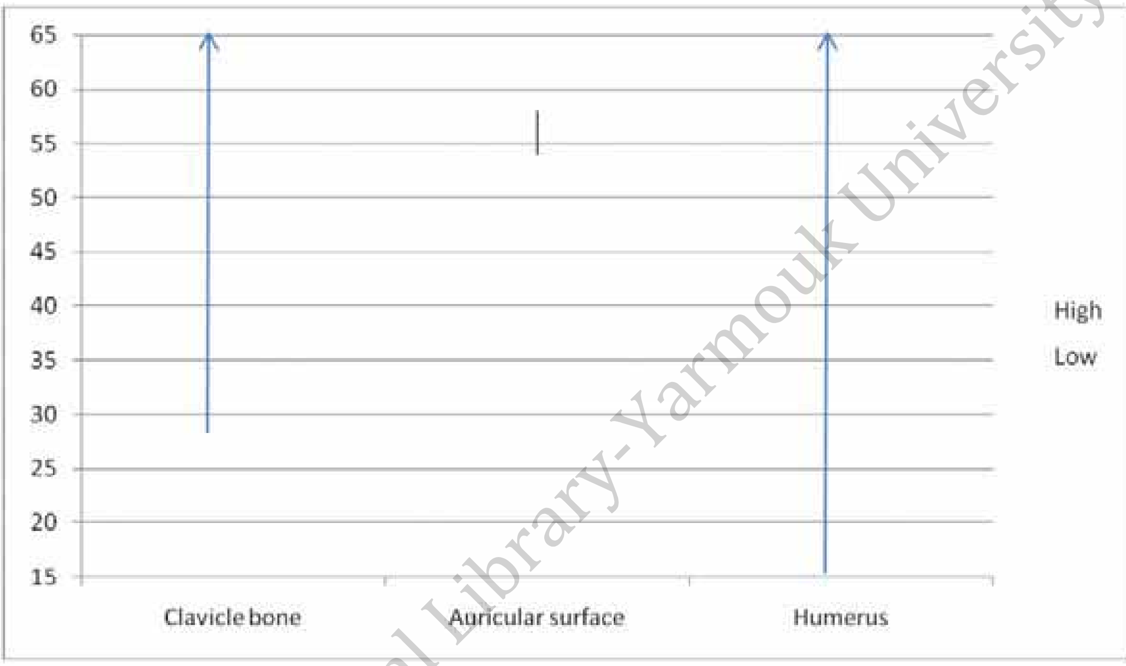


Fig. 69:- Range chart of age at death from third molar and clavicle bone, case 4 \ 1955 northern Badia.



Fig. 70:- The auricular surface, case 4 \ 1955 northern Badia.

Time elapsed since death (TESD): -

The bones were recovered from the northern Badia, which is dry and hot in summer, cold and dry in winter, this kind of climate indicats a TESD between a months and 8 years. It is evidence that the case is recent (not aechaeological) due to the presence of a denture with the bones. The presence of a piece of cotton cloth suggests a TESD between 0.5 – 10 months.

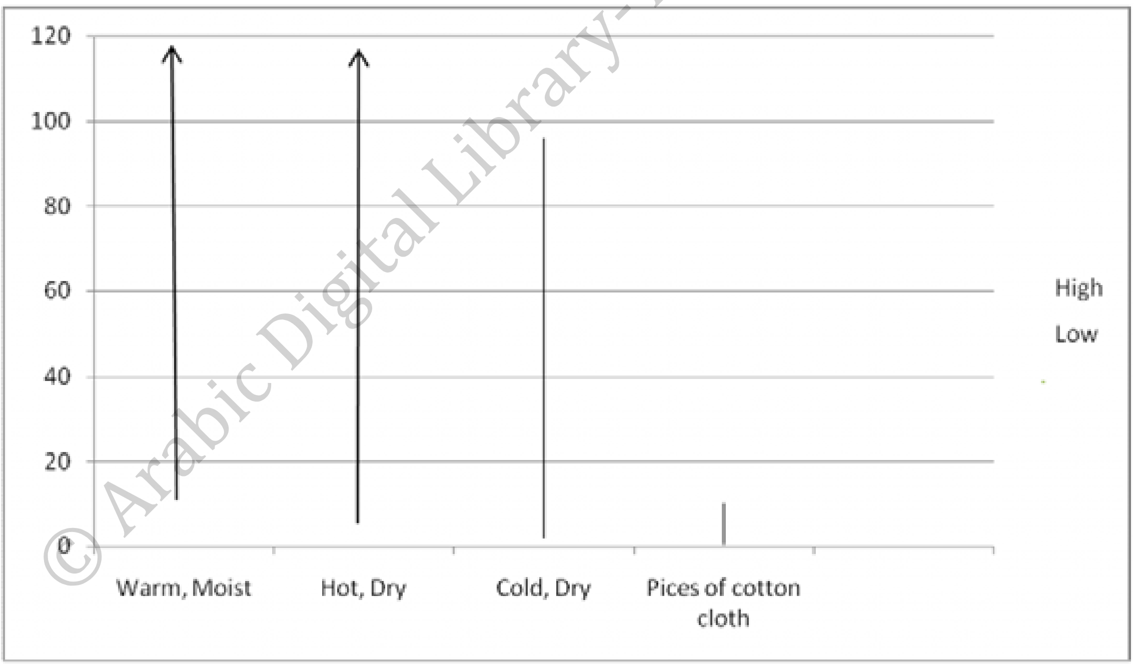


Fig. 71:- Range chart of time elapsed since death, case 4 \ 1955 northern Badia, the time in months.



Fig. 72:- Piece of cloth, 5 \ 1955 northern Badia.

Cause of death: -

Bullet injury in lift and right parietal causes the death, there are multi fractures in the cranium postmortem and antemortem, the line of fracture is not rugged, the fracture show radiating lines and the color of fracture is not lighter than the bones which strongly suggest an antemortem trauma.

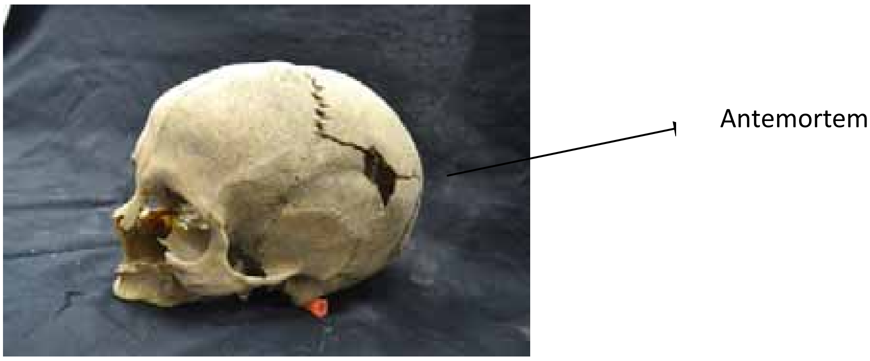


Fig. 73:- Lateral view of the cranium, case 4 \ 1955 northern Badia.



Fig. 74:- Right lateral view of the cranium; show the exit of bullet in lift parietal, case 4 \ 1955 Northern Badia.



Fig. 75:- Lateral view of the cranium, case 4 \ 1955 Northern Badia.

Manner of death: -

Unknown.

Summary:-

The case belongs to a white female measuring between 151.12 – 161.97 cm in height. She died at about an age of (54 – 58 years old) due to bullet injury

to the side of the head. The time elapsed since death is probably 0.5 – 10 months since recovery.

The presences of a denture indicate a recent corpse, probably homicide/suicide. Unfortunately, the forensic anthropologist did not accompany the team who recovered the bones, precise and careful search at the crime scene may add other materials bones.

Case 5:- Group of bones Al-Mafraq police 3350 \ 2011.

This case was brought to NIFM by Al-Mafraq Policemen and remained to be investigated until the beginning of this study. There are fractures in right parietal, temporal, and right zaygomatic, these fracture were both postmortem and antemortem fractures. The fracture in the scapula is post mortem. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994). Table 1 below shows the inventory.



Fig. 76:- Anterior view of the maxilla, case 5 \ 3350 \ 2011 Al-Mafraq.



Fig. 77:- Superior-lateral view of the cranium, case 5 \ 3350 \ 2011 Al-Mafraq.

Bone inventory:-

Table 29: The inventory of the remaining bones of case 6 \ 3350 \ 2011 Al-Mafraq.

Bone	**Side**	**Preservation**	**Fusion**
Skull		Broken	Complete
Maxilla		Broken	Complete
Scapula	Left	Broken	Complete



Fig. 78:- Anterior view of scapula, case 5 \ 3350 \ 2011 Al-Mafraq.

Table 30: Dental inventory, case 5 \ 3350 \ 2011 Al-Mafraq.

Tooth type	**Side**
UPM1	Right
UPM1	Left
UPM2	Right
UPM2	Left
UM1	Right
UM1	Left
UM2	Left
LM1	Right



Fig. 79:- Inferior view of the maxilla, case 5 \ 3350 \ 2011 Al-Mafraq.



Fig. 80:- The lower right first molar, case 5 \ 3350 \ 2011 Al-Mafraq.

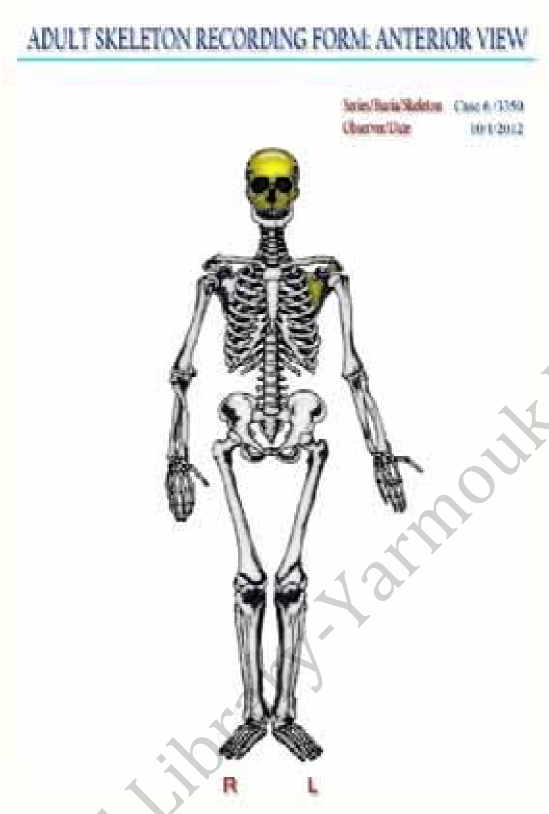


Fig. 81:- Skeletal recording of bones, case 5/3350/2011 Al - Mafraq

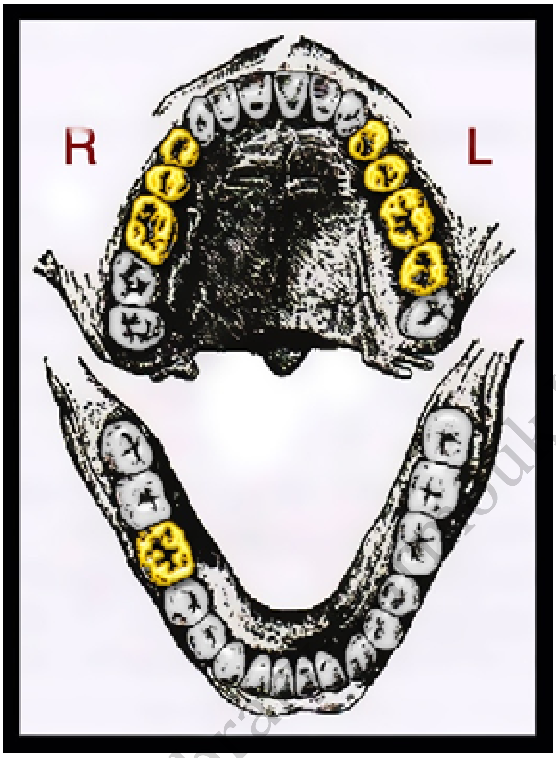


Fig. 82:- Dental recording, case 5 \ 3350 \ 2011 Al-Mafraq.

According to figures 81 and 82, some of the bones were missing.

Sex estimation:-

Table 31 shows the result of sex estimation of case number 39 \ 3350 \ 2011 Al-Mafraq, using a decision chart.

Trait	Males	Female
Size	Large and rugged	**Small and smooth**

Mastoid	**Large , projecting**	small, no projecting
Brow ridges	Large	**Small, none**
Frontal	Slanted	**High, rounded**
Nucal area	**Rugged with hook**	Small, hook uncommon
Supraorbital margin	Rounded	**Sharp**

Table 31:- The morphological features of the skull of case 5 \ 3350 \ 2011 Al-Mafraq.



Fig. 83:- Anterior view of the cranium, case 5/3350/2011 Al – Mafraq.

According to table 31, the sex of the case is mostly female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 32 shows

3350 \ 2011 Al-Mafraq.\the result of ancestry of case number 5.

Structure	**whites**	**Blacks**	**Asians**

Nose Root Bridge Lower border Spine Width	 **High ,** **Narrow** **High** Shape (sill) Narrow	 Low , Rounded Low **Guttered** **Small** Wide	 Low , Ridged Low Flat , Sharp Small **Medium**
Face Profile Sharp Eye orbits Lower eye border	 **Straight** **Narrow** **Angular** Receding	 Projecting Narrow Rectangular Receding	 Intermediate Wide Rounded **Projecting**
Vault Browridges Muscle marks	 **Heavy** **Rugged**	 Small Smooth	 Small Smooth

Vault sutures	**<u>Simple</u>**	Simple	Complex
Jaws Jaws	**<u>Parabolic</u>**	Hyperbolic	Elliptical

Table 32:- The morphological features of the vault and jaws for case number 5/ 3350 / 2011 Al-Mafraq.

Age estimation:-

The third molar is erupted at the age of 18 years. The age at death is above 18 years.

Time elapsed since death (TESD): -

No associated materials were recovered along with the bones. Also, the bones lack a definite geographical context. According of growth of the roots in the vomer bone, this indicates the roots growth after decomposition of the body (one season, 4 months at least). So the TESD is 4 months plus time required for skeletonization, which is not less than 6 months in the Mafraq

governorate. Accordingly, the TESD is probably more than 10 months. Unfortunately no associated materials were recovered. Besides, Positive identification was not performed as there were no antemortem records.

Cause of death: -

Bullet injury in right parietal causes the death, the line of fracture is not rugged, the fracture is not show radiating lines and the color of fracture lighter than the other bone.



Fig. 84:- Right lateral view of the cranium, case 5 \ 3350 \ 2011 Al-Mafraq.

Antemortem.



Fig. 85:- Superior view of the cranium, 5/3350/2011 Al – Mafraq.



Fig. 86:- Inferior view of the maxilla, with roots in vomer bone, case 5/ 3350 / 2011 Al-Mafraq.

Manner of death: -

Homicide/suicide.

Summary:-

The case belongs to a white female. She died at about an age above 18 years old due to a bullet injury in right parietal. The time elapsed since death is at least 10 months since the recovery. There were no associated materials and no antemortem records. Positive identification is not performed.

Case 6:- 2185

This case was brought to NIFM to be investigated and remained until the beginning of this study. This case was found without a skull, the vertebral column, ribs, long bones and pelvis were found connected. There were desiccated tissue in bones, all bones fused, the femur, humerus and pelvis

were broken, and this fracture is postmortem. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 87:- Lateral view of long bones and pelvis, case 6 \ 2185.



Fig. 88:- Anterior view of desiccated metatarsals, case 6 \ 2185.



Fig. 89:- Inferior view of desiccated tibia and fibula, case 6 \ 2185.



Fig. 90:- Superior posterior view of head of femur, case 6 \ 2185.



Fig. 91:- Pieces of desiccated human flesh, case 6 \ 2185.

Bone inventory:-

Table 33:- The inventory of long bones of case 6 \ 2185.

Bone	Side	Preservation	Complete	Fusion

			%	
Humerus	Right	Broken head	80%	Complete
Humerus	Left	Broken head	60%	Complete
Radius	Right	Intact	100%	Complete
Radius	Left	Intact	100%	Complete
Ulna	Right	Intact	100%	Complete
Ulna	Left	Intact	100%	Complete
Femur	Right	Broken	20%	Complete
Femur	Left	Intact	100%	Complete
Tibia	Right	Intact	100%	Complete and desiccated.
Fibula	Right	Intact	100%	Complete and desiccated.



Fig. 92:- Long bones (right and humures, right and radius and right and ulna), case 6 \ 2185.



Fig.93:- Lateral view of desiccated right leg desiccated, case 6 \ 2185.



Fig. 94:- Lateral view of femur, case 6 \ 2185.

Table 34: The inventory of the remaining bones of case 6 \ 2185.

Bone	Side	Preservation	Fusion
Illium	Right	Broken	Complete
Illium	Left	Broken	Complete
Ischium	Right	Broken	Complete
Ischium	Left	Intact	Complete
Pubis	Right	Intact	Complete
Pubis	Left	Intact	Complete
Metatarsals	Right	Intact	Complete and desiccated.

Table 35: The inventory of the vertebrae of case 6 \ 2185.

Vertebrae	Type	Preservation	Fusion
Cervical (1 – 7)	1 - 7	Intact	Complete and desiccated.
Thoracic (8 – 12)	8 – 12	Intact	Complete and

			desiccated.
Lumbar (13 – 17)	13 - 16	Intact	Complete and desiccated.



Fig. 95:- The vertebral column and rib, case 6 \ 2185.

Table 36: The inventory of the ribs of case 6 \ 2185.

Ribs	**Side**	**Preservation**
Rib 1	Right	Broken and desiccated
Rib 1	Left	Broken and desiccated

Rib 2	Right	Broken and desiccated
Rib 2	Left	Broken and desiccated
Ribs (3 – 7)	Right	Broken and desiccated
Ribs (3 – 7)	Left	Broken and desiccated
Ribs 8	Right	Broken and desiccated



Fig. 96:- Skeletal recording of bones, case 6 \ 2185.

According to figure 96, some bones were missing, because they did not recovery well.

Sex estimation:-

Table 37 shows the result of sex estimation of case number 6 \ 2185 using a decision chart.

Trait	**Male**	**Female**
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pubic shape	Narrow and rectangular	**Broad and square**
Sub pubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and triangular**

Greater sciatic notch	Narrow	**Wide**

Table 37:- The morphological features of the pelvis in case 6 \ 2185.



Fig. 97:- Anterior view of the pelvis and head of femur, case 6 \ 2185.

According to table 37, the sex of the case is mostly female.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to female.

Radius = 24 cm

ST = 4.74 * (21) + 54.93, SE = 4.24

= 154.6

= 154.6 ± (4.24 * 2)

= 154.6 ± 8.48

= (146.2 - 163.1) cm

Tibia = 47 cm

ST = 2.90 * (37) + 59.24, SE = 3.66

= 166.6

= 166.6 ± (3.66 * 2)

= 166.6 ± 7.4

= (159.2 – 174) cm

According to the range chart, the stature of this case between (159.2 – 163.1 cm) (Fig. 98).

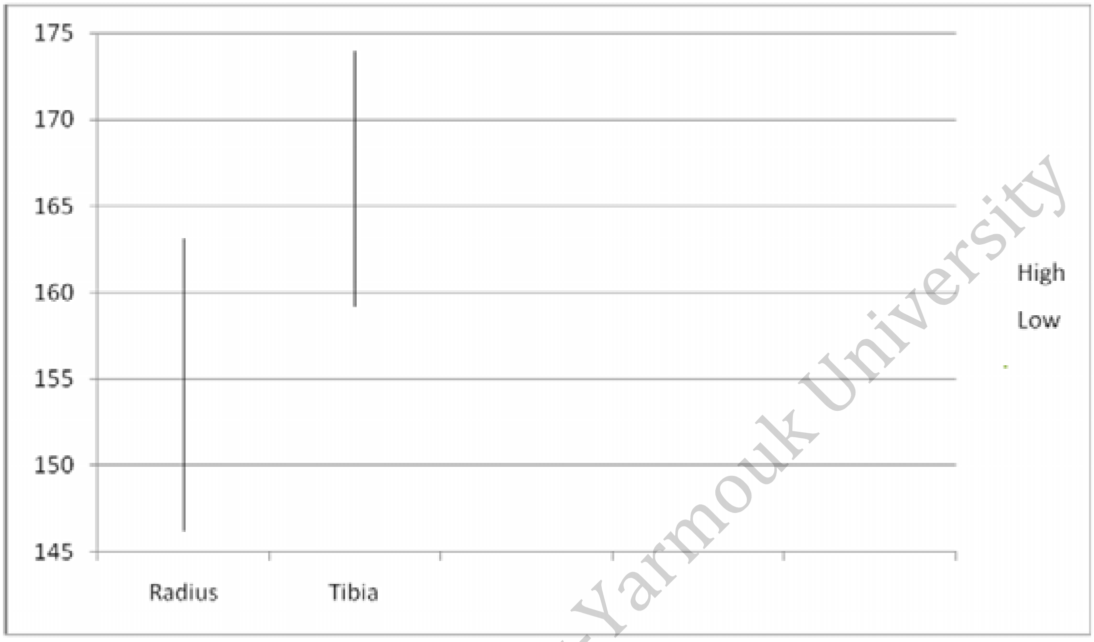


Fig. 98:- Range chart of stature from long bones, case 6 \ 2185.

Age estimation:-

Auricular surface 31 – 34 years old. Stria are strong on inferior demiface, significant transverse organization is evident especially on inferior demiface. Loss of transverse organization superiorly, uniform coarse granularity on superior demiface. Mostly fine granularity on inferior demiface, very slight retoauricular activity and no apical activity.



Fig. 99:- The auricular surface, case 6 \ 2185.

Time elapsed since death (TESD): -

This case is not having police report, but the partial desiccation happen in hot and dry climates, so the TESD is from 3 months to over 3 years. It is not known if the corpse was buried. The deterioration points to a TESD a lower range of the desiccation time.

Cause of death: -

Unknown.

Manner of death:-

Unknown

Summary:-

The case belongs to female measuring almost (159.2 – 163.1 cm) in height. She died at about an age of (31 – 34 years old). The time elapsed since death is probably around 3 months but happened in an area is not arid. The type of the burial plays a role here in determing the TESD (on surface, buried, clothed, … etc.). In addition no associated materials were recovered and there were no antemortem records or police reports. Positive identification is not performed due to the above resons.

Case 7:- 2145\ 2007 Group ob bones from known house, Aqaba.

This case was brought to NIFM by Aqaba Policemen on 20\8\2007 and remained to be investigated until the beginning of this study. They found this case in a garden of a house, 60 cm below the ground with gold rings, underwear and two red blocks. Plant roots were grown in cranium, sacrum and vertebrae column, the face is broken. A denture was found with bones. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994). Table 1 below shows the inventory.



Fig. 100:- Anterior view of the cranium, case 7\ 2145\ 2007, Aqaba.

Bone inventory:-

Table 38:- The inventory of long bones of case 7\ 2145\ 2007, Aqaba.

Bone	**Side**	**Preservation**	**Complete %**	**Fusion**
Clavicle	Right	Broken	90%	Complete
Humerus	Right	Intact	100%	Complete
Humerus	Left	Intact	100%	Complete
Radius	Right	Intact	100%	Complete
Ulna	Right	Intact	20%	Complete
Femur	Right	Broken	80%	Complete
Femur	Left	Intact	100%	Complete
Tibia	Left	Broken	90%	Complete
Fibula	Left	Intact	100%	Complete



Fig. 101:- Long bones (right and femur, tibia, fibula, right and lift humerus, right ulna and right radius), case 7\ 2145\ 2007, Aqaba.

Table 39: The inventory of the remaining e bones of case 7\ 2145\ 2007, Aqaba.

Bone	Side	Preservation	Fusion
Skull	Left	Broken	Complete
Scapula	Right	Intact	Complete
Scapula	Left	Broken	Complete
Illium	Right	Intact	Complete
Illium	Left	Intact	Complete
Ischium	Right	Intact	Complete
Ischium	Left	Broken	Complete

Pubis	Right	Intact	Complete
Pubis	Left	Intact	Complete
Sacrum		Broken	Complete
Metacarpals	Right	Intact	Complete
Metacarpals	Left	Intact	Complete
Calcaneus	Right	Intact	
Calcaneus	Left	Intact	



Fig. 102:- Anterior view of the scapula, case 7\ 2145\ 2007, Aqaba.

Table 40: The inventory of the vertebrae of case 7\ 2145\ 2007, Aqaba.

Vertebrae	**Type**	**Preservation**	**Fusion**
Cervical (1 – 7)	1 - 7	Intact	Complete
Thoracic (8 – 12)	8 – 12	Intact	Complete
Lumbar (13 – 17)	13 - 17	Intact	Complete



Fig. 103:- The vertebral column, case 7\ 2145\ 2007, Aqaba.

Table 41: The inventory of the ribs of case 7\ 2145\ 2007, Aqaba.

Ribs	**Side**	**Preservation**
Rib 1	Right	Intact
Ribs (3 – 7)	Right	Fragments
Ribs (3 – 7)	Left	Fragments
Ribs (8 – 10)	Right	Intact
Ribs (8 – 10)	Left	Intact
Ribs (11 – 12)	Right	Intact
Ribs (11 – 12)	Left	Intact



Fig. 104:- The ribs, case 7\ 2145\ 2007, Aqaba.



Fig. 105:- Skeletal recording of bones, case 7\ 2145\ 2007, Aqaba.

According to figure 171, some bones were missing.

Sex estimation:-

Tables 42 and 43 show the result of sex estimation of case number 7\ 2145\ 2007, Aqaba, using a decision chart.

Trait	Males	Female
Size	Large and rugged	**Small and smooth**
Nucal area	Rugged with hook	**Smooth, hook unknown**

Table 42:- The morphological features of the skull of case 7\ 2145\ 2007, Aqaba.

Trait	Male	Female
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pubic shape	Narrow and rectangular	**Broad and square**

Subpubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and triangular**
Greater sciatic notch	Narrow	**Wide**
Preauricular sulcus	Rare	**Well developed**
Shaped of sacrum	Long and narrow	**Short and broad**

Table 43:- The morphological features of the pelvis in case 7\ 2145\ 2007, Aqaba.



Fig. 106:- Anterior view of the pelvis, case 7\ 2145\ 2007, Aqaba.

According to tables 42 and 43, the sex of the case is mostly female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 44 shows the result of ancestry of case number 7\ 2145\ 2007, Aqaba.

Structure	Whites	Blacks	Asians
Vault			
Muscle marks	**Rugged**	Smooth	Smooth
Vault sutures	**Simple**	**Simple**	Complex
Postbregma	**Straight**	Depressed	**Straight**

Table 44:- The morphological features of the vault and jaws for case 7\ 2145\ 2007, Aqaba.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white female.

Humerus = 27.2 cm

ST = 3.36 * (27.2) + 57.97, SE = 4.45

= 149.36

= 149.36 ± (4.45 * 2)

= 149.36 ± 8.9

= (140.46 - 158.26) cm

Radius = 22 cm

ST = 4.74 * (22) + 54.93, SE = 4.24

= 159.21

= 159.21 ± (4.24 * 2)

= 159.21 ± 8.48

= (150.73 - 167.69) cm

Femur = 40 cm

ST = 2.47 * (40) + 54.74, SE = 3.72

= 153.54

= 153.54 ± (3.72 * 2)

= 153.54 ± 7.44

= (146.1 - 160.98) cm

Fibula = 32.7 cm

ST = 2.93 * (32.7) + 59.61, SE = 3.66

= 155.42

= 155.42 ± (3.66 * 2)

= 155.42 ± 7.32

= (148.1 - 162.74 cm)

According to the range chart, the stature of this case is (150.73 – 158.26 cm) (Fig. 107).

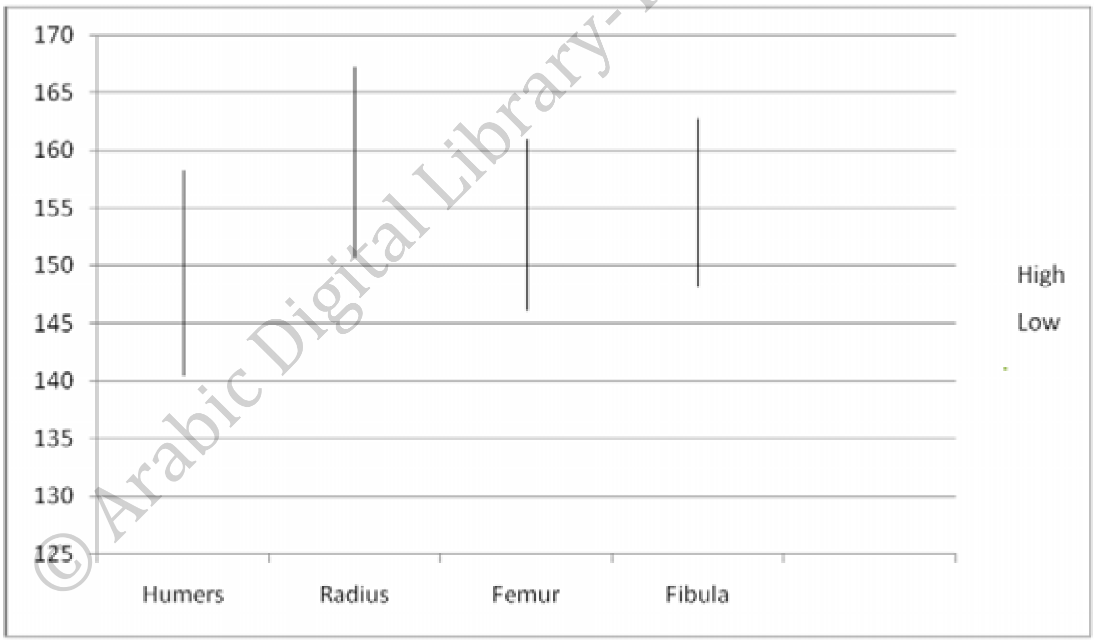


Fig. 107:- Range chart of stature from long bone, case 7\ 2145\ 2007, Aqaba.

Age estimation:-

1- The fusion of clavicle starts at the age of 27 and may continue to the age of 32 years old, the clavicle of this case is fused.

2- Auricular surface 19 – 23 years old. Marked billowing over surface, cortical bone on surface has fine-grained texture, smooth-edged youthful defects near apex, no retroauricular activity and no apical activity.

Based on this information and using the range chart, the estimated age is from (19 – 23 years old) (Fig. 108).

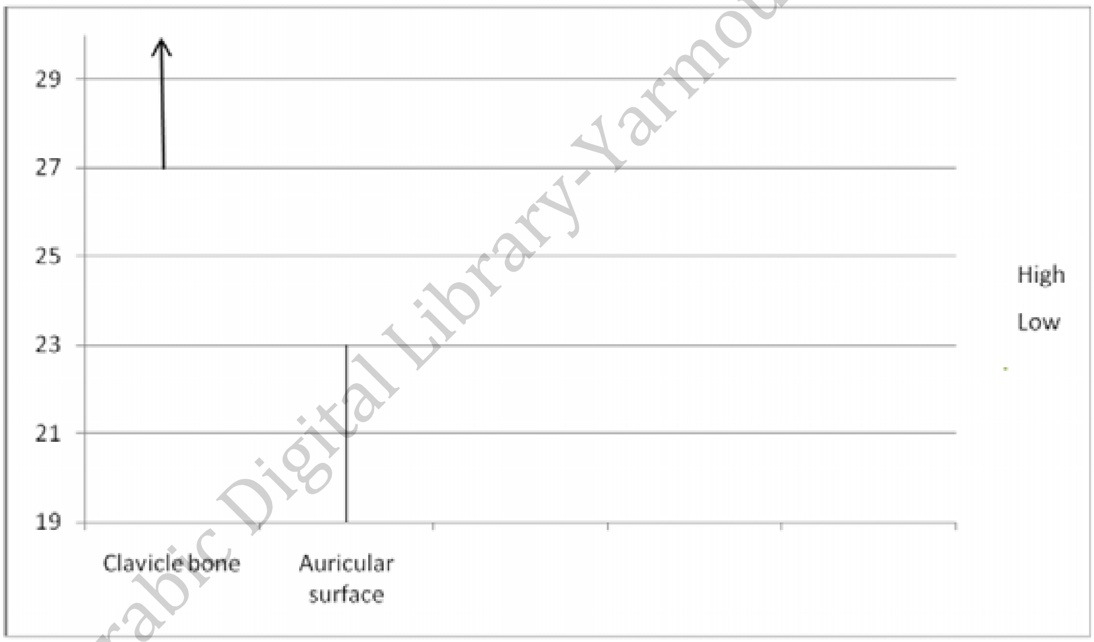


Fig. 108:- Range chart of age at death from auricular surface, pubis symphysis and clavicle bone, case 7\ 2145\ 2007, Aqaba.



Fig. 109:- The auricular surface, case 7\ 2145\ 2007, Aqaba.

Time elapsed since death (TESD): -

1- This case found in August in a garden in Aqaba, this area is hot and dry in summer; the TESD is from 9 months to over 3 years.

2- According to associated materials that were recovered like underwear (acetate or cotton) in mild deterioration, the deterioration of acetate is reached in 2 months and the deterioration of cotton is reached in 0.5 – 10 months in buried skeletons.

3- The plant has two rings; it gives an age of two years.

This means that the TESD is 2 months plus 2 years (Fig. 110).

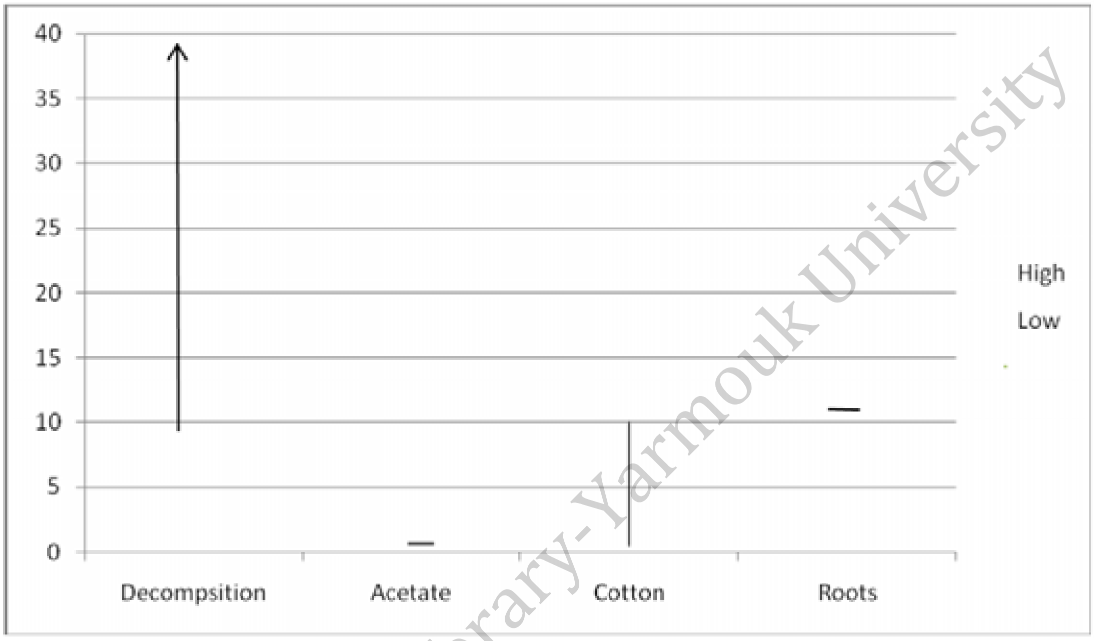


Fig. 110:- Range chart of the post mortem interval, the years in months, case 7\ 2145\ 2007, Aqaba.

Cause of death: -

Blunt trauma in occipital right and parietal causes the death, the line of fracture is not rugged, the fracture show radiating lines.



Fig. 111:- Inferior view of the cranium, with radiation fracture in occipital, case 7\ 2145\ 2007, Aqaba.

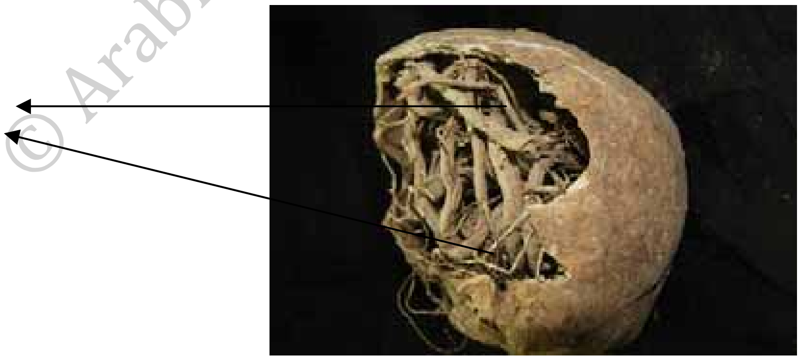


Fig. 112:- Lateral view of the cranium, case 7\ 2145\ 2007, Aqaba.



Fig. 113:- Lateral view of cranium, radiating fracture, case 7\ 2145\ 2007, Aqaba.

Manner of death: -

Homicide.

Summary:-

The case belongs to a white female measuring about 150.73 – 158.26 cm in height. She died at about an age of 19 – 23 years old due to blunt trauma of the head, the time elapsed since death is probably 2 years and 2 months at least.

Case 8:- 3371 \ 2010 Al-Jafr

This case was brought to NIFM by Al-Jafr Policemen on 15\12\2010 and remained to be investigated until the beginning of this study. They found this case in an open grave. The length of grave = 150 cm, width is 80 cm, and the depth is 90 cm. There were desiccated tissues in the lift parietal. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 114:-Lateral view of cranium, case 8 \ 3371 \ 2010 Al-Jafr.

Bone inventory:-

Table 45:- The inventory of long bones of case 8 \ 3371 \ 2010 Al-Jafr

Bone	Side	Preservation	Complete %	Fusion
Femur	Right	Intact	100%	Fused



Fig. 115:- The right femur, case 8 \ 3371 \ 2010 Al-Jafr.

Table 46: The inventory of the remaining bones of case 8 \ 3371 \ 2010 Al-Jafr.

Bone	Side	Preservation	Fusion
Skull		Intact	Fused
Maxilla		Intact	Fused

Mandible		Intact	Completely Fused
Illium	Left	Intact	Completely Fused
Ischium	Left	Intact	Completely Fused
Pubis	Left	Intact	Completely Fused
Sacrum		Intact	Completely Fused

Table 47: The inventory of the vertebrae of case 8 \ 3371 \ 2010 Al-Jafr.

Vertebrae	Type	Preservation	Fusion
Lumbar (1– 5)	3 , 5	Intact	Fused



Fig. 116:- Two lumbar vertebrae, case 8 \ 3371 \ 2010 Al-Jafr.

Table 48: Dental inventory, case 8 \ 3371 \ 2010 Al-Jafr.

Tooth type	Side
UI2	Right
UI2	Left
LC	Right
UPM1	Right
UPM1	Left
LPM1	Right
LPM1	Left
UM1	Right
UM2	Right
UM3	Right
UM1	Left
UM2	Left
LM1	Right
LM2	Right
LM1	Left
LM2	Left



Fig. 117:- Inferior view of cranium, case 8 \ 3371 \ 2010 Al-Jafr.



Fig. 118:- Superior view of the mandible, case 8 \ 3371 \ 2010 Al-Jafr.

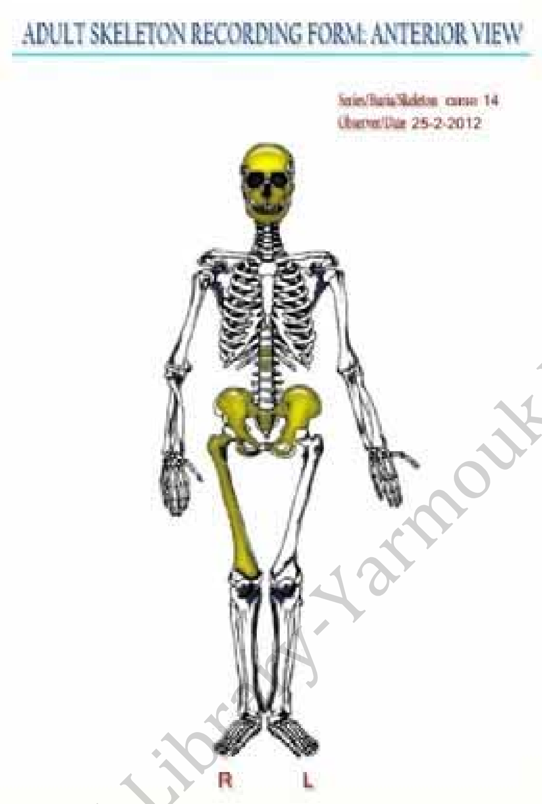


Fig. 119:- Skeletal recording of bones, case 8/3371/2010 Al-Jafr

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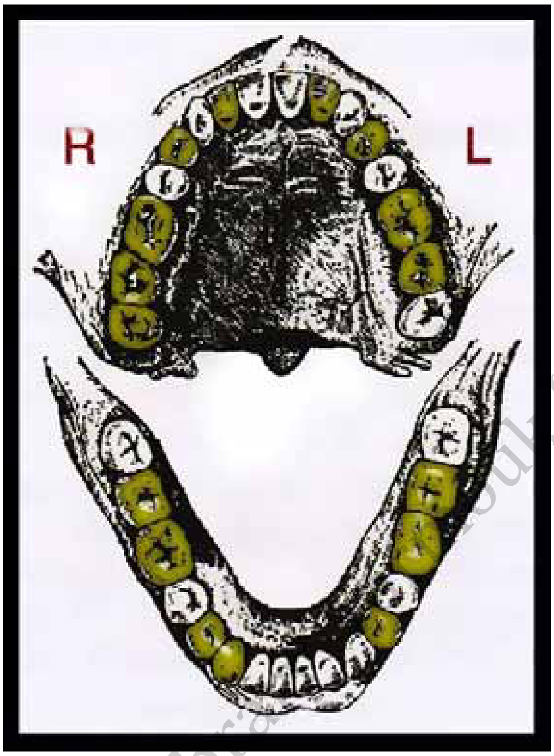


Fig 120:- Dental recording, case 8 \ 3371 \ 2010 Al-Jafr. Fig 205:- Dental

According to figures 119 and 120, some bones were missing.

Sex estimation:-

Tables 49 and 50 show the result of sex estimation of case number 8 \ 3371 \ 2010 Al-Jafr using a decision chart.

Trait	Males	Female
Size	Large and rugged	**Small and smooth**

Mastoid	**Large , projecting**	small , no projecting
Browridges	Large	**Small, none**
Frontal	**Slanted**	High, rounded
Nucal area	Rugged with hook	**Smooth, hook uncommon**
Supraorbital margin	Rounded	**Sharp**
Chin	Broad	**Pointed**

Table 49:- The morphological features of the skull of case 8/3371/2010 Al - Jafr



Fig. 121:- Lateral view of cranium, case 8/3371/2010 Al - Jafr

Trait	Males	Females
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pubic shape	Narrow and rectangular	**Broad and square**
Subpubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and triangular**
Greater sciatic notch	Narrow	**Wide**
Preauricular sulcus	Rare	**Well developed**
Shaped of sacrum	Long and narrow	**Short and broad**

Table 50:- The morphological features of the pelvis in case 8 \ 3371 \ 2010 Al-Jafr.



Fig. 122:- Anterior view of the pelvis, case8 \ 3371 \ 2010 Al-Jafr.



Fig. 123:- Anterior view of the sacrum, case 8 \ 3371 \ 2010 Al-Jafr.

According to tables 49 and 50, the sex of the case is mostly female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 51 shows the result of ancestry of case number 8 \ 3371 \ 2010 Al-Jafr.

Structure	**whites**	**Blacks**	**Asians**
Nose			
Root	**High , Narrow**	Low , Rounded	Low , Ridged
Bridge	**High**	Low	Low
Lower border	**Shape (sill)**	Guttered	Flat , Sharp
Spine	**Pronounced**	Small	Small
Width	**Narrow**	Wide	Medium
Face			
Profile	**Straight**	Projecting	Intermediate
Sharp	**Narrow**	Narrow	Wide

Eye orbits Lower eye border	**Angular** **Receding**	Rectangular **Receding**	Rounded Projecting
Vault Brow ridges Muscle marks Vault sutures Postbregma	 **Heavy** **Rugged** **Simple** Straight	 Small Smooth **Simple** **Depressed**	 Small Smooth Complex Straight
Jaws and teeth Jaws Palatal shape Upper incisors	 **Small** **Parabolic** **Spatulate**	 Large Hyperbolic **Spatulate**	 Large Elliptical Shoveled

Table 51:- The morphological features of the vault and jaws for case 8 \ 3371 \ 2010 Al-Jafr.



Fig. 124:- Anterior view of the cranium, case 8 \ 3371 \ 2010 Al-Jafr.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white female.

Femur = 30 cm

ST = 2.47 * (30) + 54.74, SE = 3.72

= 128.84

= 128.84 ± (3.72 * 2)

= 128.84 ± 7.44

= (121.4 - 136.28) cm

According to the range chart, the stature of this case is 121.4 - 136.28 cm.

Age estimation:-

1. The suture one of skull 27 – 43 years old.
2. Pubic symphyses 35 – 39 year old. Face and ventral aspect change from granular to fine-grained or dense bone. Slight changes in symphyseal face and marked changes in ventral aspect from diminishing activity. No formation of symphyseal rim. No ossification of tendinous and ligamentous attachments.
3. Auricular surface 35 – 39 years old. Striae still abundant but weak transverse organization and complete boss of billowing, uniform coarse granularity dominates entire surface, slight retroauriclar activity and no apical activity.
4. Also the third molar usually erupts at the age of 18 years; it is erupted in the case.

Based on this information and using the range chart, the estimated age is from 35 – 39 years old (Fig. 129).



Fig. 125:- Inferior view of the pelvis, case 8 \ 3371 \ 2010 Al-Jafr.



Fig. 126:- The auricular surface, case 8 \ 3371 \ 2010 Al-Jafr.



Fig. 127:- Inferior view of the cranium, case 8 \ 3371 \ 2010 Al-Jafr.



Fig.128:- Superior view of the cranium, case 8 \ 3371 \ 2010 Al-Jafr.

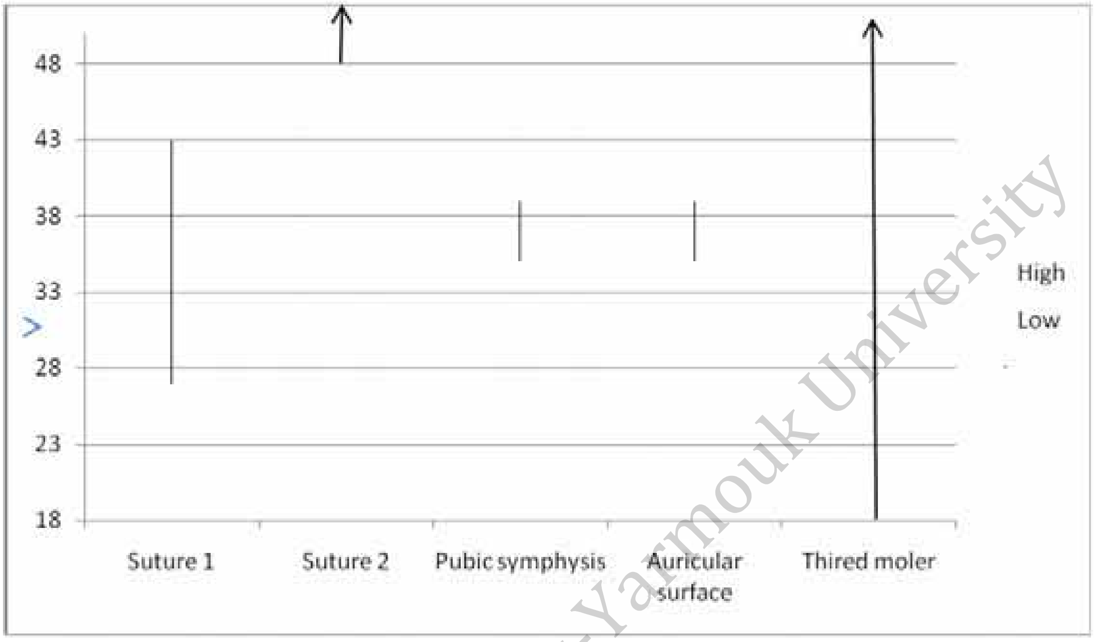


Fig. 129:- Range chart of age at death from third molar and clavicle bone, case 8 \ 3371 \ 2010 Al-Jafr.

Time elapsed since death (TESD): -

This case found in December in Al-Jafr, this area is cold and dry in winter, there are soft tissue desiccated in skull. The TESD is 4 months to 3.5 year. But the deterioration of the soft tissues is extreme leading us to think about TESD at the upper range for such an environmental; around 3.5 years. The x-ray of the skull seams normal.

Cause of death: -

Unknown.

Manner of death:-

Unknown.

Summary:-

The case belongs to a white female measuring about (121.4 - 136.28 cm) in height. She died at about an age (35 – 39 years old). The time elapsed since death is probably around to 3.5 year.



Fig. 130:- X-ray of the cranium and mandible, case 8 \ 3371 \ 2010 Al-Jafr

Case 9:- B

This case was brought to NIFM to investigated and remained until the beginning of this study. There are green and gray molds on the bones. The pelvis was connected to the femur and femur was connected to the tibia and fibula. There were desiccated tissues in the joints of long bones and pelvis. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 131:- Anterior view of cranium, case 9 \ B.



Fig. 132:- Inferior view of the cranium, case 9 \ B.



Fig. 133:- The long bones, case 9 \ B.



Fig. 134:- Anterior view of the pelvis fused with femur, case 9 \ B.



Fig. 135:- Dorsal view of the femur, case 9 \ B.



Fig. 136:- The acetabulum, case 9 \ B.

Bone inventory:-

Table 52:- The inventory of long bones of case 9 \ B.

Bone	Side	Preservation	Complete %	Fusion
Humerus	Right	Broken	90%	Complete
Humerus	Left	Broken, there is soft tissue desiccated.	80%	Complete
Radius	Right	Broken	90%	Complete
Radius	Left	Broken	90%	Complete
Femur	Right	Intact, fused	100%	Complete

		with pelvis, tibia and fibula, there are soft tissue desiccated.		
Femur	Left	There is soft tissue desiccated.	100%	Complete
Tibia	Right	Intact, fused with femur and fibula, there are soft tissue desiccated	100%	Complete
Tibia	Left	Intact, fused with fibula, there are soft tissue desiccated	100%	Complete
Fibula	Right	Intact, fused with femur and tibia, there are	100%	Complete

		soft tissue desiccated		
Fibula	Left	Intact, fused tibia, there are soft tissue desiccated	100%	Complete



Fig. 137:- The longs bone (we show the right pelvis, femur, tibia and fibula fused, and the lift tibia and fibula fused), case 9 \ B.

Table 53: The inventory of the remaining bones of case 9 \ B.

Bone	Side	Preservation	Fusion
Skull		Broken	Complete
Maxilla		Broken in incisors.	Complete
Mandible		Broken in incisors	Complete
Illium	Right	Fused with femur	Complete
Illium	Left	Intact	Complete
Ischium	Right	Fused with femur	Complete
Ischium	Left	Intact	Complete
Pubis	Right	Fused with femur	Complete
Pubis	Left	Intact	Complete

Table 54: The inventory of the vertebrae of case 9 \ B.

Vertebrae	Type	Preservation	Fusion
Lumbar (13 – 17)	13 - 16	Broken	Complete



Fig. 138:- Lateral view of the lumbar vertebrae, case 9 \ B.

Table 55: Dental inventory, case 9 \ B.

Tooth type	Side
UI1	Right
UI1	Left
UI2	Right
UI2	Left
LI2	Right
LI2	Left
UC	Right
UC	Left

LC	Right
LC	Left
UPM1	Right
UPM1	Left
LPM1	Right
LPM1	Left
UPM2	Right
UPM2	Left
LPM2	Right
LPM2	Left
UM1	Right
UM1	Left
LM1	Right
LM1	Left
UM2	Right
UM2	Left
LM2	Left



Fig. 139:-The inferior view of the upper jaw, case 9 \ B.



Fig. 140:- Superior view of the mandible, we show fracture in incisors, case 9/B

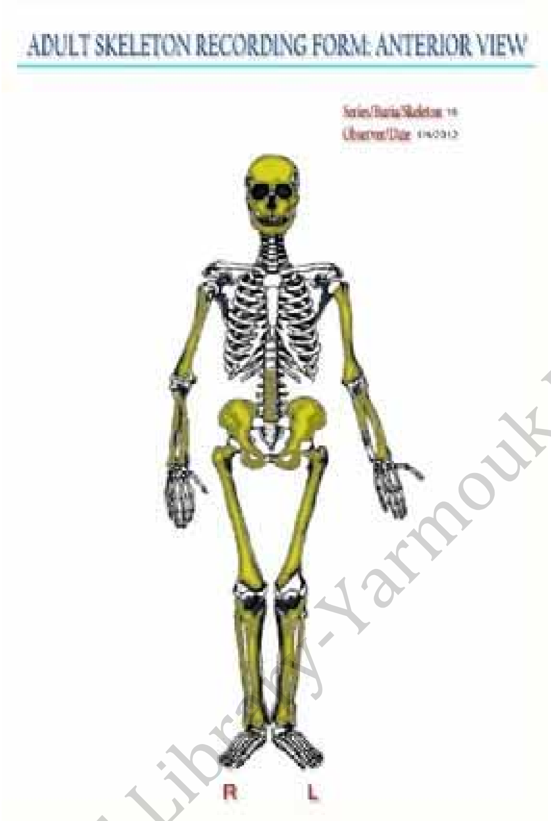


Fig. 141:- Skeletal recording of bones, case 9 \ B.

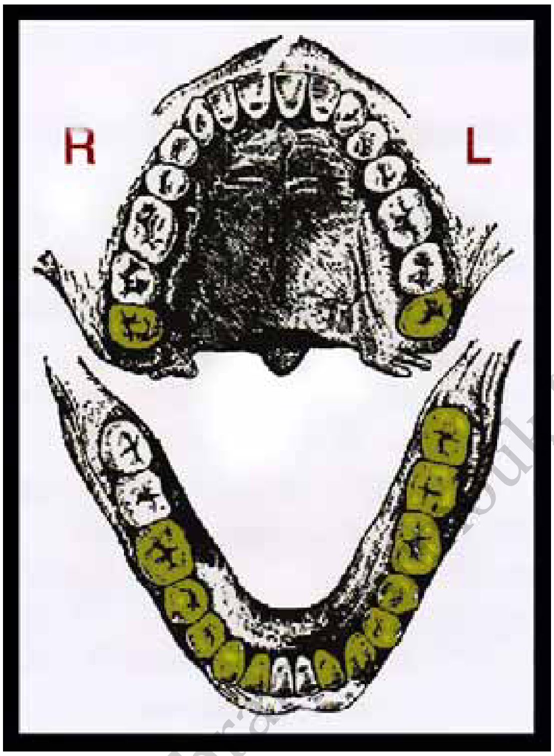


Fig 142:- Dental recording, case 9 \ B.

According to figures 141 and 142, some bones were missing.

Sex estimation:-

Tables 56 and 57 show the result of sex estimation of case number 9 \ B using a decision chart.

Trait	Males	Female
Size	Large and rugged	**Small and smooth**

Mastoid	Large , projecting	**small , no projecting**
Brow ridges	Large	**Small, none**
Frontal	Slanted	**High, rounded**
Nucal area	**Rugged with hook**	Smooth, hook uncommon
Supraorbital margin	Rounded	**Sharp**

Table 56:- The morphological features of the skull of case 9 \ B.



Fig. 143:- Lateral view of the cranium, case 9 \ B.

Trait	Males	Females
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pubic shape	Narrow and rectangular	**Broad and square**
Subpubic angle	V - shaped	**U – shaped**
Greater sciatic notch	Narrow	**Wide**

Table 57:- The morphological features of the pelvis in case 9 \ B.



Fig. 144:- Anterior view of the pelvis, case 9 \ B.



Fig. 145:- Inferior view of the pelvis, case 9 \ B.

According to tables 56 and 57, the sex of the case is mostly female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white female. Table 58 shows the result of ancestry of case number 9 \ B.

Structure	**whites**	**Blacks**	**Asians**
Nose			
Root	High , Narrow	**Low , Rounded**	Low , Ridged
Lower border	**Shape (sill)**	Guttered	Flat , Sharp
Spine	**Pronounced**	Small	Small
Width	**Narrow**	Wide	Medium
Face			
Profile	**Straight**	Projecting	Intermediate
Sharp	**Narrow**	**Narrow**	Wide
Eye orbits	**Angular**	Rectangular	Rounded
Lower eye border	**Receding**	**Receding**	Projecting
Vault			
Brow ridges	**Heavy**	Small	Small
Muscle marks	Rugged	**Smooth**	**Smooth**

Vault sutures Postbregma	Simple Straight	Simple **Depressed**	**Complex** Straight
Jaws and teeth Jaws Palatal shape Upper incisors	 **Small** Parabolic **Spatulate**	 Large **Hyperbolic** **Spatulate**	 Large Elliptical Shoveled

Table 58:- The morphological features of the vault and jaws for case 9 \ B.

Age estimation:-

1- The third molar usually erupts at the age of 18 years, erupted.

2- Auricular surface 31 – 34 years old. Striae strong on inferior demiface, significant transverse organization are evident especially on inferior demiface. Loss of transverse organization superiorly, uniform coarse granularity on superior demiface. Mostly fine granularity on inferior demiface, very slight retoauricular activity and no apical activity.

3- Suture of skull give age (34 – 45 years old).

Based on this information and using the range chart, the estimated age is almost 34 years old (Fig. 147).



Fig. 146:- The auricular surface, case 9 \ B.

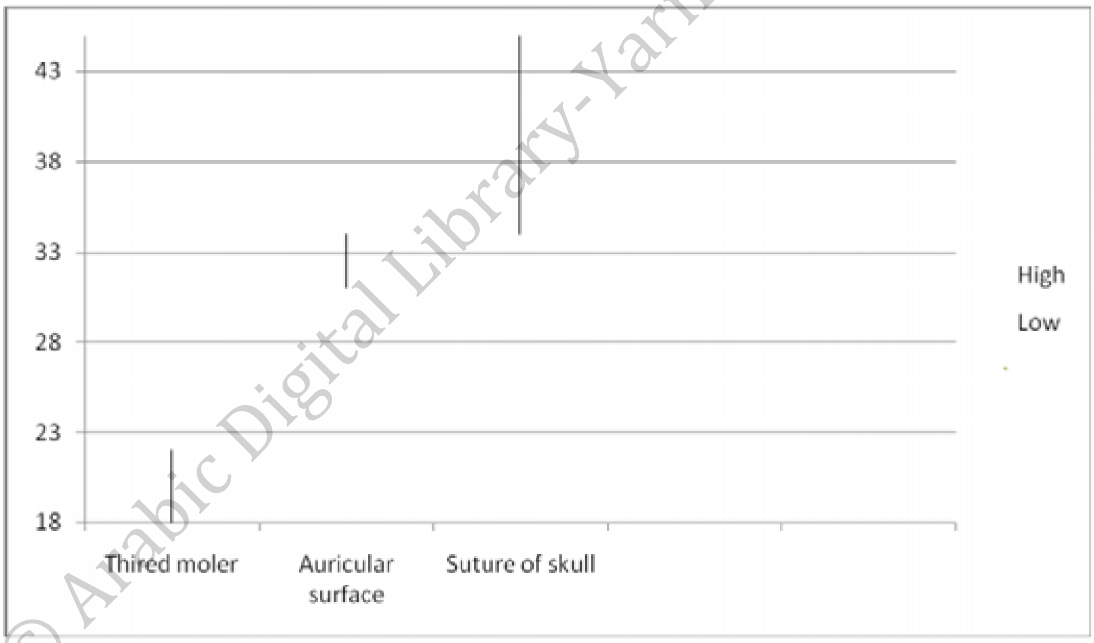


Fig. 147:- Range chart of age at death from the third molar and clavicle bone, case 9 \ B.

Time elapsed since death (TESD):-

This case does not have police report, so we determine the TESD according to three climate in Jordan:-

1 - Warm, Moist climates. (In the first year the corpse is skletonized).

2 -Hot, Dry climates. (From 3 months to over 3 years the corpse is skletonized).

3 -Cold, Dry climates. (From 4 months to 3.5 years the corpse is skletonized). The TESD is from (1 – 3.5 years old) (Fig. 148), but the decomposition move the TESD to its upper limit as soft decomposition is extreme.

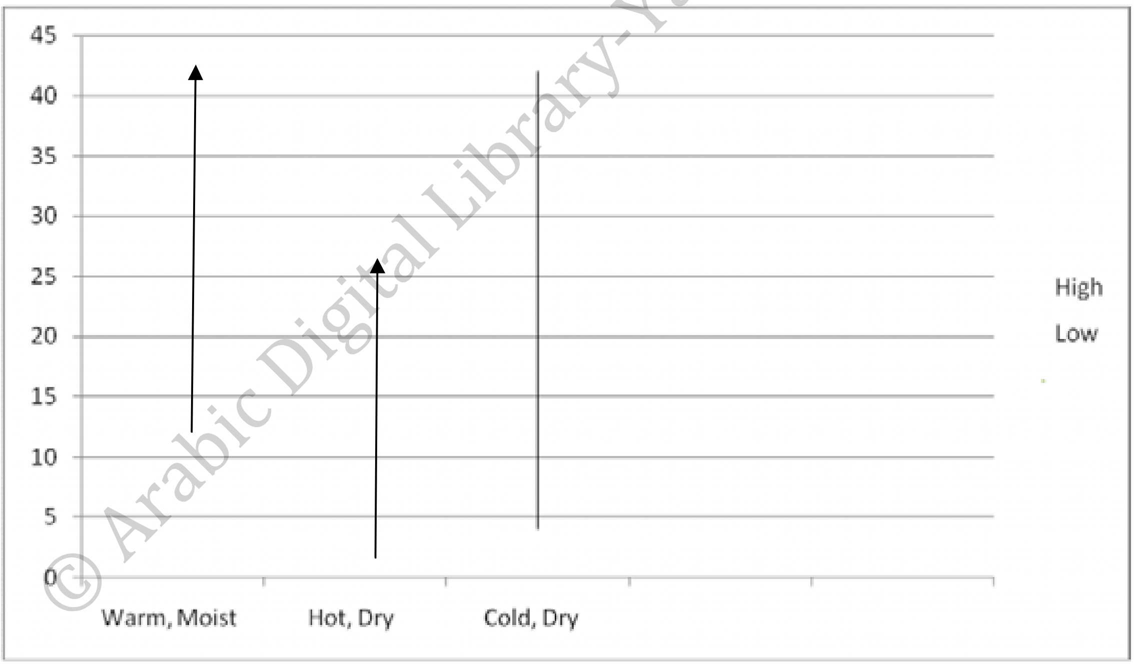


Fig. 148:- Range chart of time elapsed since death, case 9 \ B.

Cause of death: -

Gunshot, the entrance in right parietal, the exit in lift parietal and occipital, the fracture shows radiating lines.

Postmortem

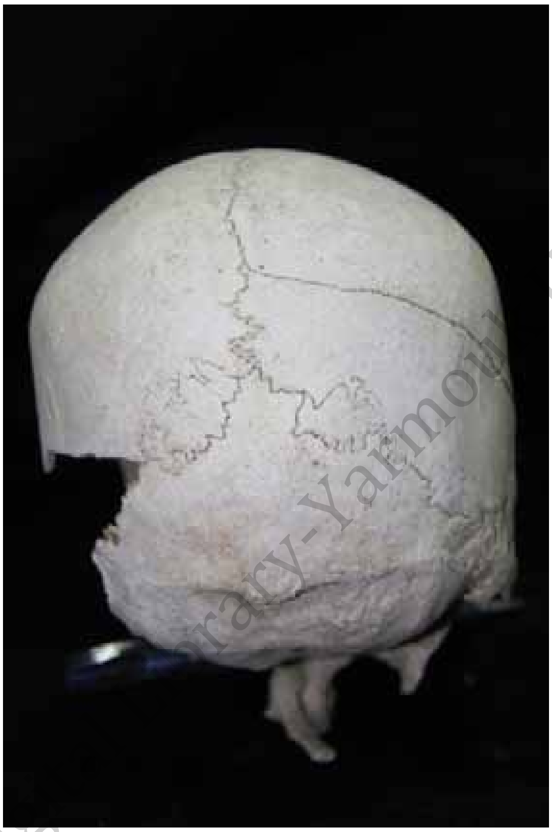


Fig. 149:- Inferior view of the cranium, case 9 \ B.

Ante mortem



Because it extends the surface line

Fig. 150:- Right lateral view of the cranium, case 9 \ B.

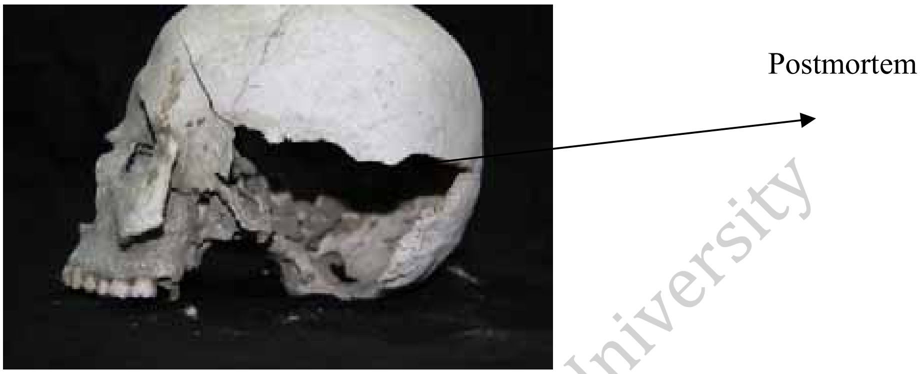


Fig. 151:-Lateral view of the cranium, case 9 \ B.

Manner of death:-

Homicide/suicide.

Summary:-

The case belongs to a white female. She died at an age of about from 34 years old due to a gunshot to the right side of the head. The time elapsed since death is probably about 3 years.



Fig. 152:- The x-ray of cranium shows the radiating fracture in the parietal bone, occipital, frontal and temporal, case, 9 \ B.

Case 10:- 3081 \ 2011 Al-Jeza.

This case was brought to NIFM by Al-Jeza Policemen on 21\10\2011 and remained to be investigated until the beginning of this study. They found this case in carton box (20 * 30 cm), on the side of agricultural road near the landfill buildings, linking Zababer and Al- Talbeiah camp. The bones were found in a good condition. A blue mark on the right parietal and occipital was noticed, this mark indecates the existence of a piece of metal under the

head. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 153:- Inferior view of the cranium, case 10 \ 3081 \ 2011 Al-Jeza.

Bone inventory:-

Table 59:- The inventory of long bones of case 10 \ 3081 \ 2011 Al-Jeza.

Bone	Side	Preservation	Complete %	Fusion

Humerus	Right	Intact	100%	Complete
Ulna	Left	Intact	100%	Complete
Femur	Right	Intact	100%	Complete
Femur	Left	Intact	100%	Complete
Tibia	Left	Intact	100%	Complete
Fibula	Left	Intact	100%	Complete



Fig. 154:- The long bones (right femur, lift tibia, lift fibula right humerus and lift ulna), case 10 \ 3081 \ 2011 Al-Jeza

Table 60: The inventory of the remaining bones of case 10 \ 3081 \ 2011 Al-Jeza.

Bone	Side	Preservation	Fusion
Skull		Intact	Complete
Maxilla		Intact	Complete
Illium	Right	Intact	Complete
Illium	Left	Intact	Complete
Ischium	Right	Intact	Complete
Ischium	Left	Intact	Complete
Pubic	Right	Intact	Complete
Pubic	Left	Intact	Complete
Sacrum		Intact	Complete
Metacarpals	Right	Intact	Complete

Table 61: The inventory of the vertebrae of case 10 \ 3081 \ 2011 Al-Jeza.

Vertebrae	Type	Preservation	Fusion
Thoracic (8 – 12)	8th	Intact	Complete



Fig. 155:- The 8th thoracic vertebrae, case 10 \ 3081 \ 2011 Al-Jeza

Table 62: The inventory of the ribs of case 10 \ 3081 \ 2011 Al-Jeza.

Ribs	Side	Preservation
Ribs (8 – 10)	Right	Intact
Ribs (11 – 12)	Right	Intact
Ribs (11 – 12)	Left	Intact



Fig. 156:- The ribs, case 10 \ 3081 \ 2011 Al-Jeza

Table 63: Dental inventory, case 10 \ 3081 \ 2011 Al-Jeza.

Tooth type	Side
UC	Left
UM1	Right
UM1	Left
UM2	Right
UM2	Left



Fig. 157:- Inferior view of the cranium, case 10 \ 3081 \ 2011 Al-Jeza



Fig. 158:- The loosed teeth, case 10 \ 3081 \ 2011 Al-Jeza

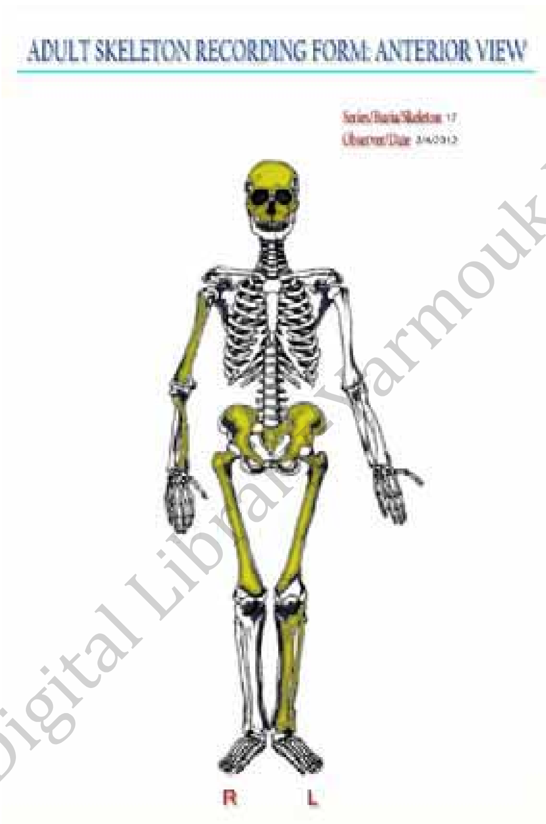


Fig. 159:- Skeletal recording of bones, case 10 \ 3081 \ 2011 Al-Jeza.

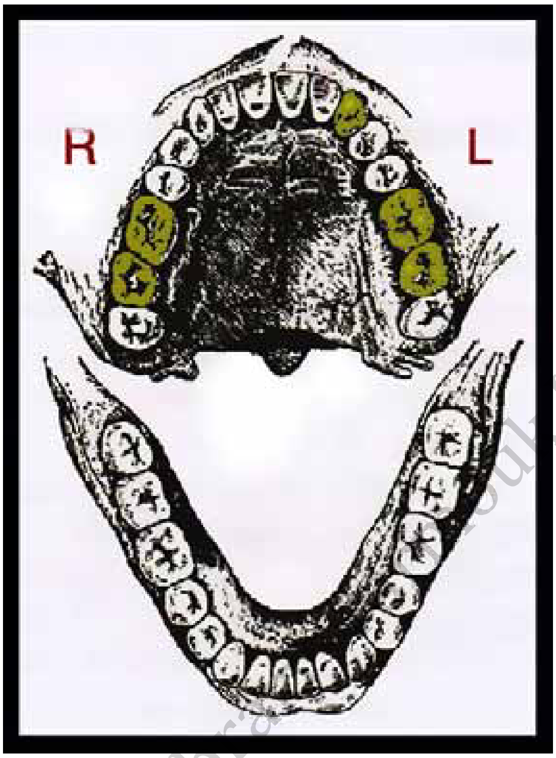


Fig 160:- Dental recording, case 10 \ 3081 \ 2011 Al-Jeza

According to figures 159 and 160, some bones were missing.

Sex estimation:-

Tables 64 and 65 show the result of sex estimation of case number 10 \ 3081 \ 2011 Al-Jeza using a decision chart.

Trait	Males	Female
Size	Large and rugged	**Small and smooth**

Mastoid	**Large , projecting**	small , no projecting
Brow ridges	Large	**Small, none**
Frontal	Slanted	**High, rounded**
Nucal area	Rugged with hook	**Smooth, hook uncommon**
Supraorbital margin	Rounded	**Sharp**

Table 64:- The morphological features of the skull of case 10 \ 3081 \ 2011 Al-Jeza.



Fig. 161:- Lateral view of the cranium, case 10 \ 3081 \ 2011 Al-Jeza

Trait	**Males**	**Females**
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pubic shape	**Narrow and rectangular**	Broad and square
Subpubic angle	V - shaped	**U – shaped**
Obturator foramen	**Large and ovoid**	Small and triangular
Greater sciatic notch	Narrow	**Wide**
Shaped of sacrum	Long and narrow	**Short and broad**

Table 65:- The morphological features of the pelvis in case 10 \ 3081 \ 2011 Al-Jeza.



Fig. 162:- Dorsal view of the pelvis, case 10 \ 3081 \ 2011 Al-Jeza.



Fig. 163:- Dorsal view of sacrum, case 10 \ 3081 \ 2011 Al-Jeza

According to tables 64 and 65, the sex of the case is mostly female.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 66 shows the result of ancestry of case number 10 \ 3081 \ 2011 Al-Jeza.

Structure	**whites**	**Blacks**	**Asians**
Nose			
Root	**High , Narrow**	Low , Rounded	Low , Ridged
Bridge	**High**	Low	Low
Lower border	**Shape (sill)**	Guttered	Flat , Sharp
Spine	Pronounced	**Small**	**Small**
Width	**Narrow**	Wide	Medium
Face			
Profile	**Straight**	Projecting	Intermediate
Sharp	**Narrow**	**Narrow**	Wide
Eye orbits	**Angular**	Rectangular	Rounded
Lower eye border	**Receding**	**Receding**	Projecting
Vault			
Brow ridges	**Heavy**	Small	Small
Muscle marks	**Rugged**	Smooth	Smooth

Vault sutures Postbregma	**<u>Simple</u>** Straight	**<u>Simple</u>** **<u>Depressed</u>**	Complex Straight
Jaws and teeth Jaws Palatal shape	 **<u>Small</u>** **<u>Parabolic</u>**	 Large Hyperbolic	 Large Elliptical

Table 66:- The morphological features of the vault and jaws for case 10 \ 3081 \ 2011 Al-Jeza.



Fig. 164:- Anterior view of the cranium, case 10 \ 3081 \ 2011 Al-Jeza

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white male.

Humerus = 26.3 cm

ST = 3.36 * (26.3) + 57.97, SE = 4.45

= 146.34

= 146.34 ± (4.45 * 2)

= 146.34 ± 8.9

= (137.44 - 155.24) cm

Ulna = 21.1 cm

ST = 4.27 * (21.1) + 57.76, SE = 4.30

= 147.86

= 147.86 ± (4.30 * 2)

= 147.86 ± 8.6

= (139.26 - 156.46) cm

Femur = 36.7 cm

ST = 2.47 * (36.7) + 54.74, SE = 3.72

= 145.39

= 145.39 ± (3.72 * 2)

= 145.39 ± 7.44

= (137.95 - 152.83) cm

Tibia = 31.2 cm

ST = 2.90 * (31.2) + 59.24, SE = 3.66

= 149.72

= 149.72 ± (3.66 * 2)

= 149.72 ± 7.32

= (142.4 - 157.04) cm

Fibula = 29.3 cm

ST = 2.93 * (29.3) + 59.61, SE = 3.57

= 145.46

= 145.46 ± (3. 57 * 2)

= 145.46 ± 7.14

= (138.32 - 152.6) cm

According to the range chart, the stature of this case is (142.4 – 152.6 cm) (Fig. 165).

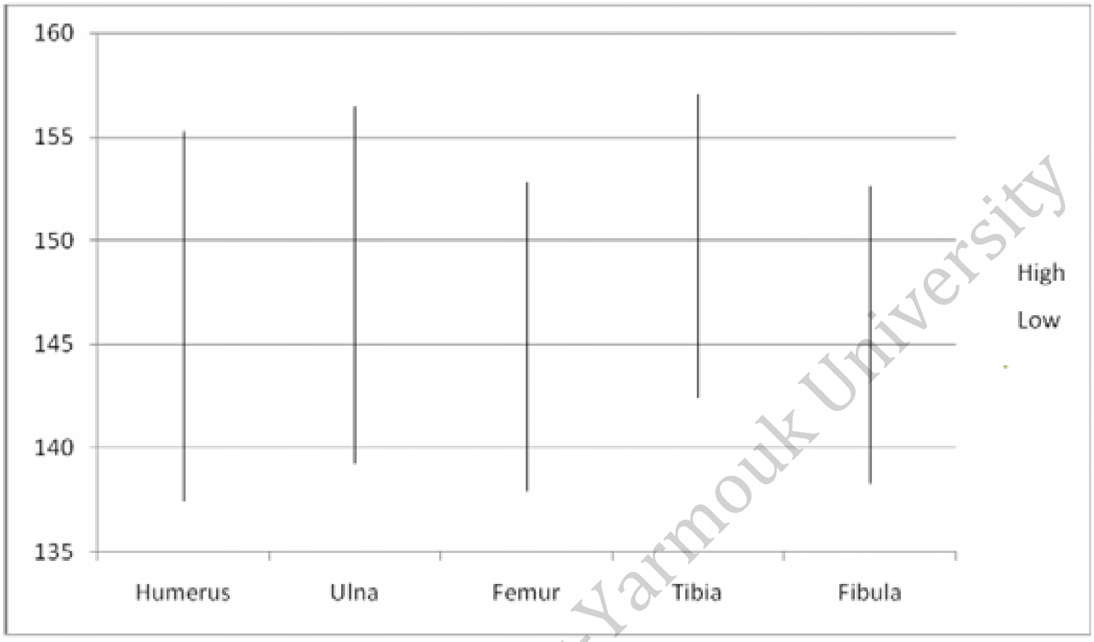


Fig. 165:- Range chart of stature from long bones, case 10 \ 3081 \ 2011 Al-Jeza.

Age estimation:-

1- Pubic symphysis 25 – 26 years old. Great increase of ventral beleved area. Correspondind diminution of ridge and furrow formation. Complete definition of dorsal margin through the formation of the dorsal platform. Commencing delimitation of lower extremity.

2- Auricular 24 – 26 years old. Transverse organization prominent, especially on inferior demiface, but less than typical overall. Residual billowing at inferior margin. Fine granularity evident over most of surface.

Some slight coarse granulanity has worn cortical bone in places. No retroauricular activity. No significant apical activity.

Based on this information and using the range chart, the estimated age is (24-26 years old) (Fig. 170).



Fig. 166:- Lateral view of the cranium, case 10 \ 3081 \ 2011 Al-Jeza



Fig. 167:- posterior view of the cranium, case 10 \ 3081 \ 2011 Al-Jeza



Fig. 168:- Dorsal view of pelvis, case 10 \ 3081 \ 2011 Al-Jeza



Fig. 169:- The auricular surface, case 10 \ 3081 \ 2011 Al-Jeza

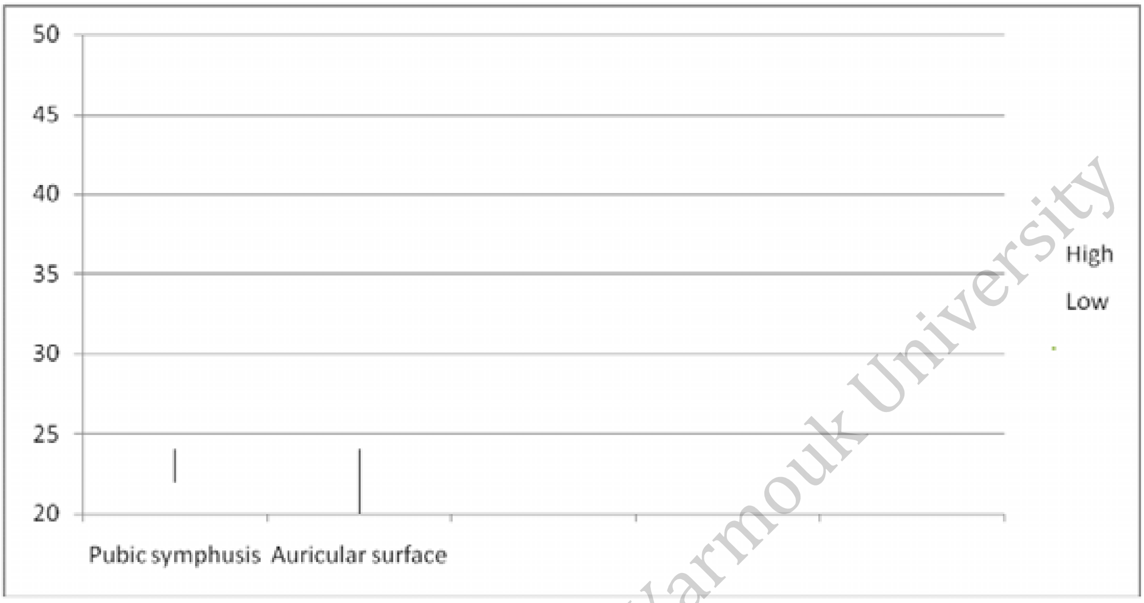


Fig. 170:- Range chart of age at death from the third molar and the auricular surface, case 10 \ 3081 \ 2011 Al-Jeza.

Time elapsed since death (TESD): -

This case found in October in Al-Jeza, this area is cold and dry in autumn, the TESD is 2 months to less than 8 years.

Cause of death: -

Unknown.

Manner of death:-

Unknown

Summary:-

This case belongs to a white female measuring about (142.4 – 152.6 cm) in height. She died at about an age 24 - 26 years old. The time elapsed since

death is to 2 months to less than 8 years. Unfortunately there no associated material and antemortem records. Positive identification was no performed due to the bore reasons.

Case 11:- 957 \ 2008 Aqaba.

This case was brought to NIFM by Al-Aqaba Policemen on 6\4\2008 and remained to be investigated until the beginning of this study. This case was found buried at a depth 70 cm near a wall of a mosque. The skull was fragmented, the fracture is postmortem, and the fracture in long bones is postmortem. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 171:- Fragments of the skull, case 11 \ 957 \ 2008 Aqaba.

Bone inventory:-

Table 67:- The inventory of long bones of case 11 \ 957 \ 2008 Aqaba.

Bone	Side	Preservation	Complete %	Fusion
Humerus	Right	Broken	80%	Complete
Femur	Right	Intact	100%	Complete

Femur	Left	Broken	100%	Complete
Tibia	Right	Intact	100%	Complete
Fibula	Right	Intact	100%	Complete



Fig. 172:-The long bones (right and femur, right tibia and right fibula), case 11 \ 957 \ 2008 Aqaba.

Table 68: The inventory of the remaining bones of case 11 \ 957 \ 2008 Aqaba.

Bone	Side	Preservation	Fusion
Skull		Fragments	Complete
Illium	Left	Intact	Complete
Ischium	Left	Broken	Complete
Pubic	Left	Intact	Complete
Patalle	Right	Intact	

Table 69: The inventory of the vertebrae of case 11 \ 957 \ 2008 Aqaba.

Vertebrae	Type	Preservation	Fusion
Cervical (1 – 7)	1	Broken in body	Completely fused
Thoracic (8 – 12)	8 - 9	Broken in body	Completely fused



Fig. 173:- One cervical (Atlas) and two of thoracic vertebrae, case 11 \ 957 \ 2008 Aqaba.



Fig. 174:- Skeletal recording of bones, case 11 \ 957 \ 2008 Aqaba.

According to figure 174, some bones were missing.

Sex estimation:-

Tables 70 show the result of sex estimation of case number 11 \ 957 \ 2008 Aqaba using a decision chart.

Trait	**Males**	**Females**
Size	Large and rugged	**Small and gracile**
Ilium	High and vertical	**Low and flat**
Pubic shape	Narrow and rectangular	**Broad and square**
Subpubic angle	V - shaped	**U – shaped**
Obturator foramen	Large and ovoid	**Small and**

		triangular
Greater sciatic notch	Narrow	**Wide**

Table 70:- The morphological features of the pelvis in case 11 \ 957 \ 2008 Aqaba.



Fig. 175:- Posterior - lateral view of the pelvis, case 11 \ 957 \ 2008 Aqaba.

According to table 70, the sex of the case is mostly female.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white female.

Femur = 45 cm

ST = 2.47 * (45) + 54.74, SE = 3.72

= 165.89

= 165.89 ± (3.72 * 2)

= 165.89 ± 7.44

= (158.45 - 173.33) cm

Fibula = 37 cm

ST = 2.93 * (37) + 59.61, SE = 3.66

= 168.02

= 168.02 ± (3.66 * 2)

= 168.02 ± 7.32

= (160.7 - 175.34) cm

Tibia = 35 cm

ST = 2.90 * (35) + 59.24, SE = 3.66

= 160.74

= 160.74 ± (3.66 * 2)

= 160.74 ± 7.4

= (160.7 – 173.33) cm

According to the range chart, the stature of this case between (160.7 – 168.14 cm) (Fig. 176).

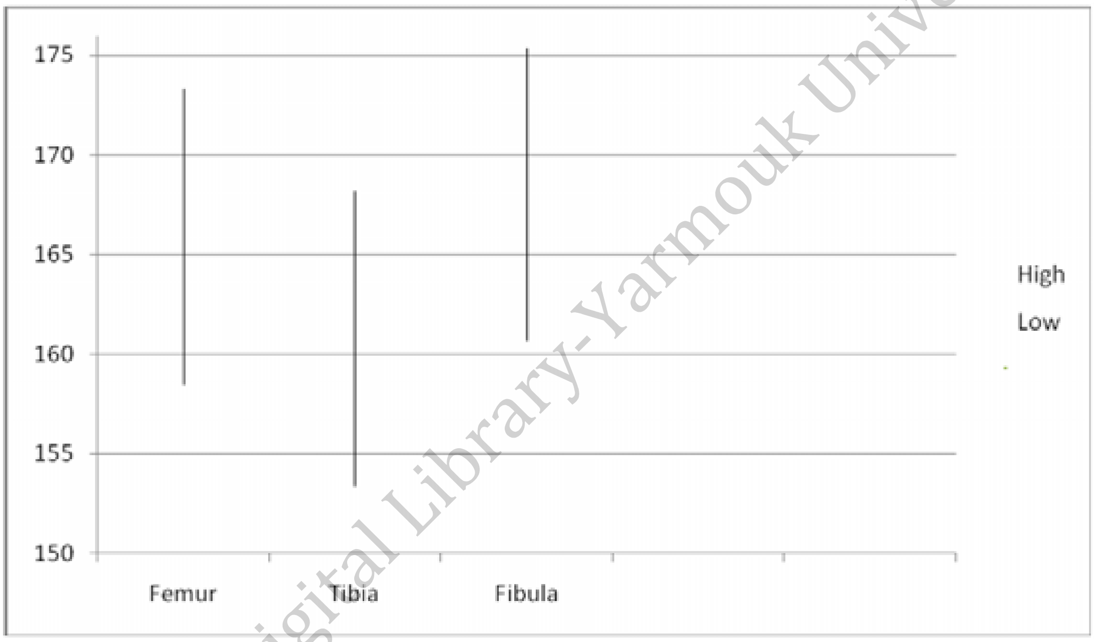


Fig. 176:- Range chart of stature from long bones, case 11 \ 957 \ 2008 Aqaba.

Age estimation:-

Auricular surface 19 – 24 years old. Marked billowing over surface. Cortical bone on surface has fine-grained texture. Smooth-edged youthful defects near apex. No retroauricular activity. No apical activity.

Based on this information, the estimated age is reached to (19 – 24 years old).

Time elapsed since death (TESD): -

Skeletonization in Aqaba as the soil is hot and moist might be reached in less than 6 months.

Cause of death: -

Unknown.

Manner of death: -

Unknown.

Summary:-

This case belongs to a white female measuring about 160.7 – 168.14 cm in height. She died at an age of about 19 – 24 years old. The time elapsed since death is unknown, because there were no associated material, but skeletonization in Aqaba region as the soil is hot and moist might be reached in less than 6 months.

Case 12:- Al-Jeza mummy 1795:-

The corpse was found in the Al-Jeza area and brought to the National Institute for Forensic Medicine (NIFM) in the city of Amman.

Al-Jeza is situated in southern part of Amman muniapality, where the average temperature is about 20.1°C in summer and 12.1°C in winter. The amount of rainfall is 25.9 mm annually. This area is cold and dry, this led to dehydrates the soft tissue of the corpse leading to natural mummification if death occurs in summer.

The mummy was examined visually and then by x-ray radiography.

The visual examination:-

The mummy was examined to determine the age at death, sex, stature, ancestry, cause of death and manner of death. The sex is female according to the external genitalia. The ancestry is white based on the external

morphology of the face and nose as well as the radiographic characteristics of the skull.

Table 71: - Visual and radiographic characteristics of the skull.

Structure	**Morphology typical to white ancestry**
Hair	Straight
Eye orbits	Angular
Nose bridge	High
Profile of face	Straight
Mandible	Parabolic

We cannot determine the stature because we don't take the x-ray photography, of the long bones.

The age was estimated according to fused clavicle bone and the eruption of the third molar. All of third molars were erupted (the upper and lower).

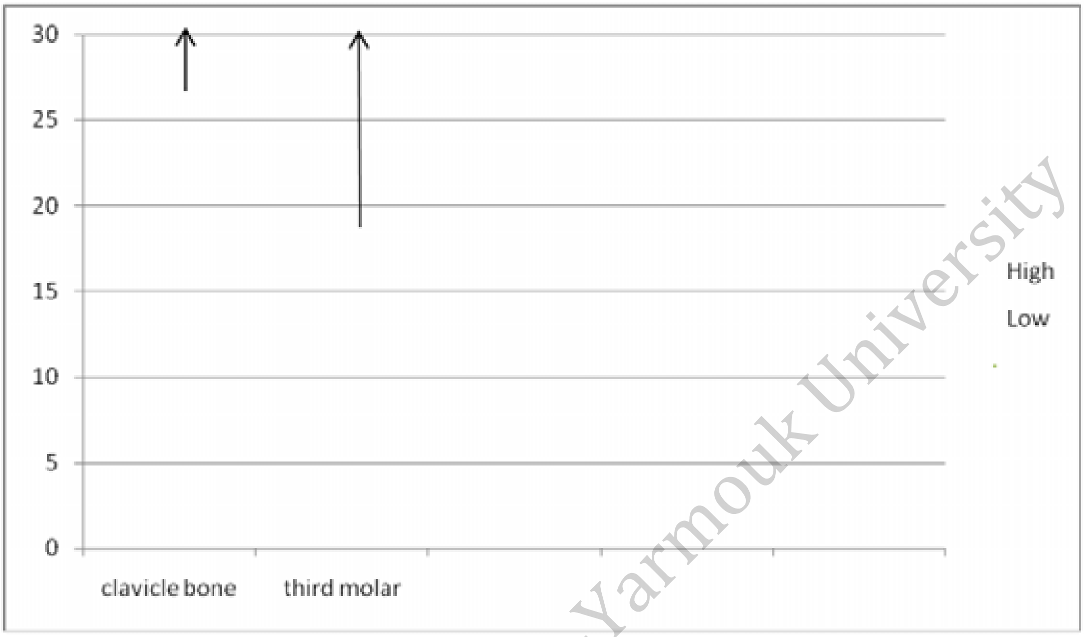


Fig 177:- Range chart of age at death, Case 12 mummy Al-Jeza 1795.

The age at death of this mummy is above 27 years old.



Fig 178:- Frontal view of the mummy shows the external genitalia indicated an adult female, Case 12 mummy Al-Jeza 1795.



Fig 179:- Frontal view of the head of the mummy, Case 12 mummy Al-Jeza 1795.

Tine elapsed since death (TESD):-

We cannot determine the time elapsed death because there no more associated material with mummy to establish a precise TESD. Radiocarbon dating is necessary to establish the forensic context.

We note several traumas in the body:-

1- There are broken ribs (first lift and right, and 4-6 ribs).

2- Multiple trauma in the scalp caused by a contact to a rough surface.

So the cause of death was probably attributed to a blunt force trauma applied to the area of the chest, and the manner of death unknown.



Fig 180:- Anterio lateral view of the chest, Case 12 Al-Jeza mummy 1795.

The position of death noted by extended the body on its back and right side, the lift arm over the abdomen, the right leg over the left leg, leg semi extended.

She probably died an attended. There was no entomological evidence with corpse and we don't take any fingerprints.

The presence of plant roots on the and right feet indicate that the corpse was placed in underground burial.

The corpse was dissected by pathologists at NIFM, but they didn't reach a cause of death.

The separation of the head from the body took place after the death because:-

1- The hyoid bone is present as seen in the x-ray radiography.

2- There is no cut mark on the base of skull.



Fig 181:- Anterior view of the neck, the first vertebra is thoracic, Case 12 mummy Al-Jeza 1795.

X-ray Radiography:-

The radiographic examination of the skull revealed the upper and lower third molar. There were no traumas in skull.



Fig 182:- X-ray of the skull shows the third molar and the hayoed bone, Case 12 mummy Al-Jeza 1795.

CHAPTER

Four

Chapter Four

Case 13:- 1954 \ 2007

Group of bones from Karak city.

This case was brought to NIFM on 1\8\2007 and remained to be investigated. These bones were found on 30 \ 7 \ 2007 in the Al – Karak Castle. Most of the bones were found broken; the fibula is bent, the bones of the pelvis, , ribs and scapula are not fused. The third molar was erupted, some animal bones were found along with this case.



Fig. 183:- Anterior lateral view of the skull, case 13 \ 1954 \ 2007 Karak city.



Fig. 184:- Bending fibula, case 13 \ 1054 \ 2007 Karak city.



Fig. 185:- Fragment of animal bones, case 13 \ 1054 \ 2007 Karak city.

Bone inventory:-

Table 72:- The inventory of long bones of case 13 \ 1054 \ 2007 Karak city.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Right	Broken	90%	Complete
Humerus	Right	Intact	100%	Complete
Humerus	Left	Intact	100%	Complete
Radius	Right	Intact	100%	Complete
Radius	Left	Intact	100%	Complete
Ulna	Right	Intact	100%	Complete
Ulna	Left	Intact	100%	Complete
Femur	Left	Intact	100%	Complete
Fibula	Right	Intact	100%	Complete

Fibula	Left	Broken		
Tibia	Right	Intact	100%	Complete
Tibia	Left	Intact	100%	Complete



Fig. 186:- Long bones (femur, right and tibia, right and fibula, right and lift 1954 \ 2007 \humerus, right and lift ulna, and right and lift radius), case 13 Karak city.

Table 73: The inventory of the irregulars bones of case 2 \ 1054 \ 2007 Karak city.

Bone	Side	Preservation	Fusion
Skull		Fragments	Complete

Maxilla		Broken	Complete
Mandible		Broken	Complete
Scapula	Right	Broken	Complete
Scapula	Left	Broken	
Illium	Right	Intact	Complete
Iillium	Left	Intact	Complete
Ischium	Right	Intact	Complete
Ischium	Left	Intact	Complete
Pubis	Right	Intact	Complete
Pubis	Left	Intact	Complete
Patella	Left	Intact	Complete
Metacarpals	Right	Intact	Complete
Metacarpals	Left	Intact	Complete
Metatarsals	Right	Intact	Complete
Metatarsals	Left	Intact	Complete



Fig. 187:- Anterior view of right clavicle bone, case 13 \ 1954 \ 2007 Karak city.



Fig 188:- Anterior view of scapulae, case 13 \ 1954 \ 2007 Karak city.

Table 74: The inventory of the vertebrae, case 13 \ 1054 \ 2007 Karak city.

Vertebrae	**Type**	**Preservation**	**Fusion**
Cervical (1 – 7)	1 - 7	Broken	Complete
Thoracic (8 – 12)	8 – 12	Broken	Complete
Lumbar (13 – 17)	13 - 16	Broken	Complete



Fig. 189:- The vertebral column, case 13 \ 1954 \ 2007 Karak city.

Table 75: The inventory of the ribs, case 13 \ 1054 \ 2007 Karak city.

Ribs	**Side**	**Preservation**
Rib 1	Right	Intact, surface erosion and discoloration
Rib 1		Intact, surface erosion and discoloration
Ribs (3 – 7)	Right	Fragments, surface erosion and discoloration
Ribs (3 – 7)		Fragments, surface erosion and discoloration
Ribs (8 – 10)	Right	Fragments, surface erosion and discoloration
Ribs (8 – 10)		Fragments, surface erosion and discoloration
Ribs (11 – 12)	Right	Fragments, surface erosion and discoloration
Ribs (11 – 12)		Fragments, surface erosion and discoloration



Fig 190:- Rib and rib fragments, case 13 \ 1954 \ 2007 Karak city.

Table 76: Dental inventory, case 13 \ 1054 \ 2007 Karak city.

Tooth type	Side
UI1	Right
UI2	Right
UI1	Left
UI2	Left
UC	Left
LC	Right
LC	Left
UPM2	Right
UPM1	Left
UPM2	Left
UM1	Right

UM1	Left
UM2	Right
UM2	Left
UM3	Right
UM3	Left
LM1	Right
LM1	Left
LM2	Right
LM2	Left
LM3	Right



Fig. 191:- Inferio posterior view of right and lift maxilla, case 13 \ 1954 \ 2007 Karak city.



Fig. 192:- Superior view of the mandible, case 13 \ 1954 \ 2007 Karak city.



Fig. 193- Skeletal recording of bone, case 13 - 1954 \ 2007 Karak city.

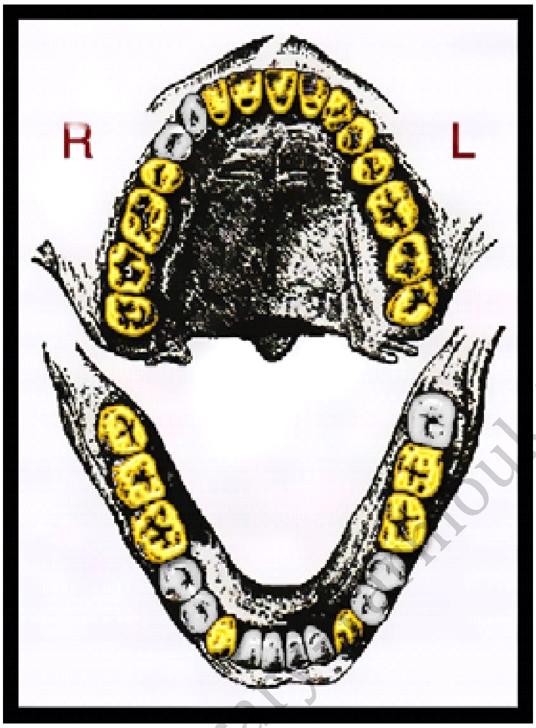


Fig. 194:- Dental recording, case 13 \ 1954 \ 2007 Karak city.

According to figures 193 and 194, some bones were missing. These bones were probably on the surface at that time of recovery.

Sex estimation:-

Tables 77 and 78 show the results of sex estimation of case number 2 \ 1954 \ 2007 using a decision chart.

Trait	Males	Female
Mastoid	**Large , projecting**	small , no projecting

Brow ridges	**Large**	Small , None
Frontal	**Slanted**	High , Rounded

Table 77:- The morphology features of the skull of case 13 \ 1954 \ 2007 Karak city.

Trait	Male	Female
Size	**Large and rugged**	Small and gracile
Ilium	**High and vertical**	Low and flat
Pubic shape	**Narrow and rectangular**	Broad and square
Subpubic angle	**V - shaped**	U – shaped

Obturator foramen	**Large and ovoid**	Small and triangular
Greater sciatic notch	**Narrow**	Wide

Table 78:- The morphological features of the pelvis of case 13\ 1954 \ 2007 Karak city.

According to tables 77 and 78, the sex of the case is mostly male.



Fig. 195:- Lateral view of the skull, case 13 \ 1954 \ 2007 Karak city.



Fig. 196:- Inferior view of pelvis, case 13 \ 1954 \ 2007, Karak city.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 79 shows the result of ancestry of case number 13\ 1954 \ 2007 Karak city.

Structure	Whites	Blacks	Asians
Nose			
Root	**High**	Low , Rounded	Low , Ridged
Bridge	**Narrow**	Low	Low
Lower border	**High**	Guttered	Flat , Sharp
Spine	**Shape (sill)**	Small	Small
Width	Narrow	Wide	**Medium**
Face			
Profile	**Straight**	Projecting	Intermediate
Sharp	**Narrow**	Narrow	Wide

Eye orbits Lower eye border	**Angular** **Receding**	Rectangular Receding	Rounded Projecting
Jaws and teeth Jaws Palatal shape Upper incisors	 **Small** **Parabolic** **Spatulate**	 Large Hyperbolic **Spatulate**	 Large Elliptical Shoveled

Table 79:- The morphological features of the vault and jaws for case number 13\ 1954 \ 2007 Karak city.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white male.

Humerus = 31.8 cm

ST = 3.08 * (31.8) + 70.45, SE = 4.05

= 168.39

= 168.39 ± (4.05 * 2)

= 168.39 ± 8.1

= (160.29 - 176.49) cm

Radius = 24.5 cm

ST = 3.78 * (24.5) + 79.01, SE = 4.32

= 171.62

= 171.62 ± (4.32 * 2)

= 171.62 ± 8.64

= (162.98 - 180.50) cm

Ulna = 26.8 cm

ST = 3.70 * (26.8) + 74.05, SE = 4.32

= 173.21

= 173.21 ± (4.32 * 2)

= 173.21 ± 8.64

= (164.57 - 181.85) cm

Femur = 45 cm

ST = 2.38 * (45) + 61.41, SE = 3.27

= 168.51

= 168.51 ± (3.27 * 2)

= 168.51 ± 6.54

= (161.97 - 175.05) cm

Tibia = 39 cm.

ST = 2.52 * 39 + 78.62, SE = 3.37

= 176.9

= 176.9 ± (3.37 * 2)

= 176.9 ± 6.74

= (170.16 – 183.64) cm

Fibula = 36.8 cm.

ST = 2.68 * 36.8 + 71.78, SE = 3.29

= 170.40

= 170.40 ± (3.29 * 2)

= 170.40 ± 6.58

= (163.82 – 176.98) cm.

According to the range chart, the stature of this case is (170.16 – 175.05 cm) (Fig. 197).

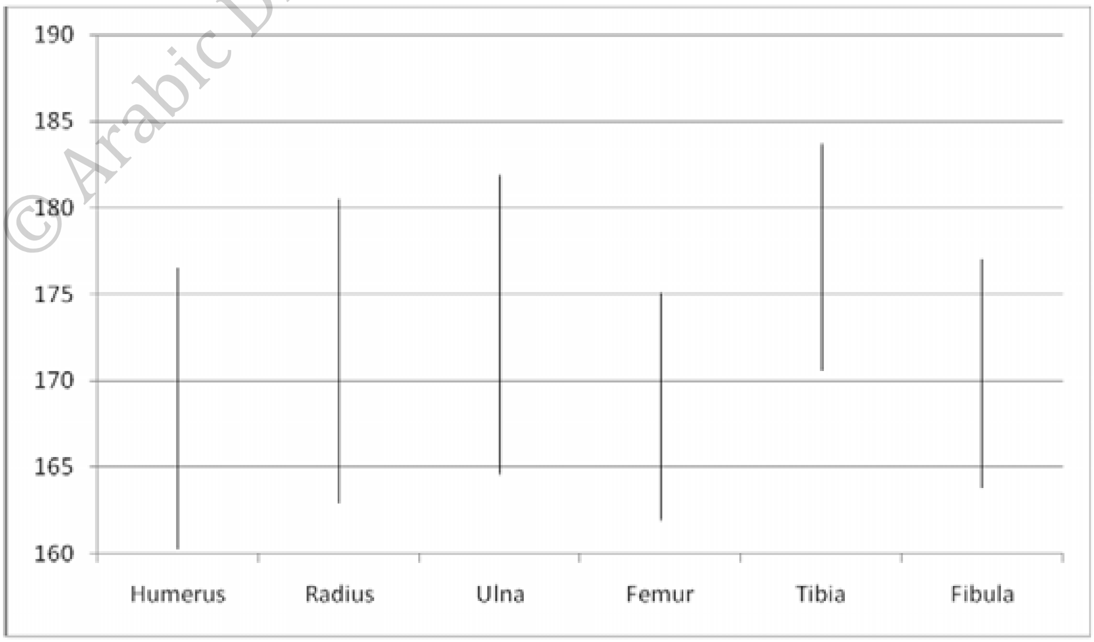


Fig. 197:- Range chart of stature from long bones, case 13\ 1954 \ 2007 Karak city.

Age estimation:-

1. The fusion of clavicle starts at the age of 27 years old and may continue to the age of 32 years old, the clavicle of this case is fused.
2. The third molar usually erupts at the age of 18 years old, the third molar is erupted.
3. The pubic symphsis show an age from (30 – 35 years old), development and practical completion of ventral rampart. Retention of some granular appearance of symphyseal face indicating that activity has not yet ceased. Failure of ventral aspect of pubis adjacent to ventral rampart to become transformed into a compact surface. The rampart is somewhat undermined. Retention of the pectinate outline of the dorsal margin and slight ridge and furrow system. No lipping of ventral margin and no increased lipping of dorsal margin.
4. Auricular surface shows an age from (31 – 34 years old). Stria are strong on the inferior demiface, significant transverse organization is evident especially on inferior demiface. Loss of transverse organization superiorly, uniform coarse granularity on superior

demiface. Fine granularity on inferior demiface, very slight retoauricular activity and no apical activity.

Based on these information and using the range chart, the estimated age is about 31 – 34 years old (Fig. 198).

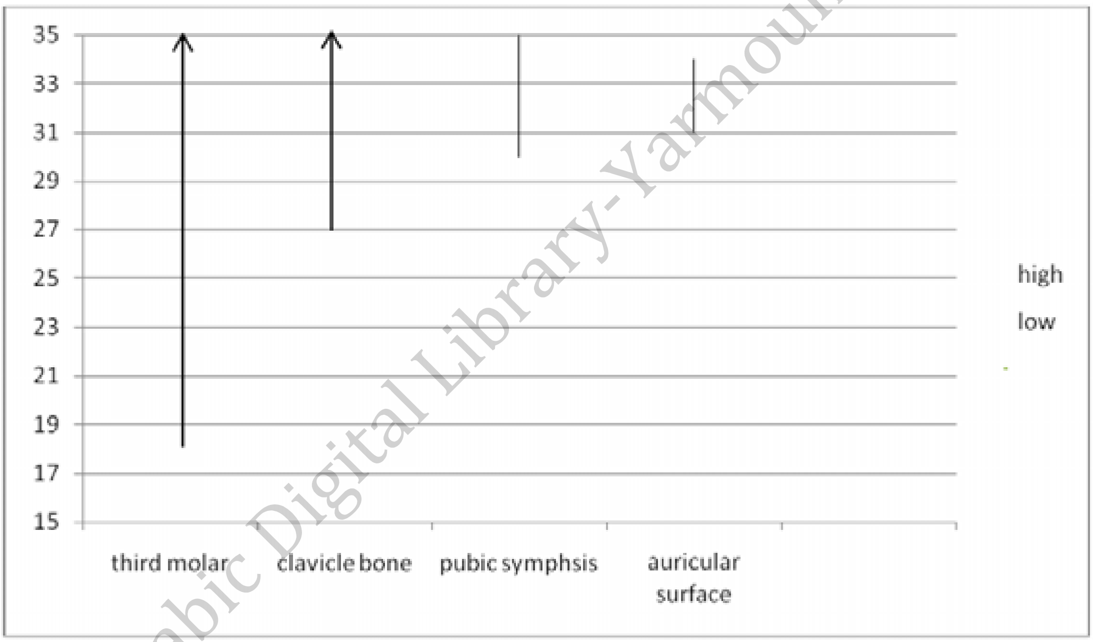


Fig. 198 :- Range chart of age at death from third molar, clavicle bone, pubic symphsis, and articular surface, case 13 \ 1954 \ 2007 Karak city.



Fig. 199:- The articular surface, case 13 \ 1954 \ 2007 Karak city.

Time elapsed since death (TESD): -

The corpse was found fully skeletonized, and probably partially covered with soil at the time of recovery due to the presence of erosion and discoloration at the surface of the ribs. The climate at the Karak Castle is hot and dry in summer, and cold and humid in winter. In addition, there is a very high difference between day and might temperatures, which enhances decomposition. Accordingly, full skeletonization in such a case might be reached in less than six months. Further investigations are needed to eliminate the possibility that this case is archeological, for example, radiocarbon dating, which is beyond the budget of this study.

Cause of death: -

Head injury is mostly premortem because the line of fracture is not rugged, the fracture shows radiating lines and the color of fracture is not lighter than the rest of the bones.

Manner of death: -

Unknown.

Summary:-

This case belongs to a white male measuring about 170.16 – 175.05 cm in height. He died at about an age of about 31 – 34 years old due to a blunt trauma to the side of the head. The time elapsed since death is probably more than 6 months. There is a possibility that the case is archeological, where radiocarbon dating is needed. Unfortunately, no associated material, were recovered with the skeleton. In addition, the burial type is not known and there is no evidence of dental treatment (amalgams), which increases the probability of being archaeological.

Case 14:- 1463 \ 2007

Group of human bones \ unknown.

This case was brought to NIFM and remained to be investigated until the beginning of this study. This case was found without a skull, the vertebral column found connected, the bones have discoloration and fused. The skin of right and leg is desiccated. There is a cut mark in lift leg. We note the presence of straw between the toes. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994). Table 1 below shows the inventory.



Fig. 200:- Medial view of lift leg, the adipocere, case 14 \ 1463 \ 2007



Fig. 201:- Dorsal view of lift leg, the adipocere formation, case 14 \ 1463 \ 2007



Fig. 202:- Inferior view of lift leg, the adipocere and skin is mummified, case 14 \ 1463 \ 2007.

Bone inventory:-

Table 80:- The inventory of long bones of case 14 \ 1463 \ 2007.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Right	Intact	100%	Complete and discoloration
Clavicle	Left	Intact	100%	Complete and discoloration
Humerus	Right	Intact	100%	Complete and discoloration
Ulna	Right	Intact	100%	Complete and discoloration
Femur	Right	Intact	100%	Complete and discoloration
Femur	Left	Intact	50%	Complete and discoloration
Tibia	Right	Intact	100%	Complete and discoloration
Tibia	Left	Intact	50%	Complete and discoloration

Fibula	Right	Intact	100%	Complete and discoloration
Fibula	Left	Intact	100%	Complete and discoloration



Fig. 203:- Long bones (Right and femur, Right and tibia, Right and fibula, right humerus, right ulna), case 14 \ 1463 \ 2007.

Table 81: The inventory of the remaining bones of case 14 \ 1463 \ 2007.

Bone	Side	Preservation	Fusion
Scapula	Right	Intact	Complete and discoloration
Sternum		Intact	Complete and discoloration
Sacrum		Intact	Complete and discoloration
Illium	Right	Intact	Complete and discoloration
Illium	Left	Intact	Complete and discoloration
Ischium	Right	Intact	Complete and discoloration
Ischium	Left	Intact	Complete and discoloration
Pubis	Right	Intact	Complete and discoloration
Pubis	Left	Intact	Complete and discoloration

Metatarsals	Right	Intact	Complete and discoloration
Metatarsals	Left	Intact	Complete and discoloration



Fig. 204:- The scapula, case 14 \ 1463 \ 2007.



Fig. 205:- The sternum, case 14 \ 1463 \ 2007.

Table 82: The inventory of the vertebrae of case 14 \ 1463 \ 2007.

Vertebrae	**Type**	**Preservation**	**Fusion**
Thoracic (8 – 12)	7 – 12	Intact	Complete and discoloration
Lumbar (13 – 17)	13 - 17	Intact	Complete and discoloration



Fig. 206:- The vertebrae, case 14 \ 1463 \ 2007.

Table 83: The inventory of the ribs of case 14 \ 1463 \ 2007.

Ribs	Side	Preservation
Rib 1	Right	Intact and discoloration
Rib 2	Left	Intact and discoloration
Ribs (3 – 7)	Right	Intact and discoloration
Ribs (3 – 7)	Left	Intact and discoloration
Ribs (8 – 10)	Right	Intact and discoloration
Ribs (8 – 10)	Left	Intact and discoloration
Ribs (11 – 12)	Right	Intact and discoloration
Ribs (11 – 12)	Left	Intact and discoloration



Fig. 207:- The ribs, case 14 \ 1463 \ 2007.



Fig. 208:- Skeletal recording of bones, case 14 \ 1463 \ 2007.

According to figure 208, some bones were missing. These bones were probably on the surface at that time, or probably the site was not excavated properly.

Sex estimation:-

Table 84 shows the result of sex estimation of case number 14 \ 1463 \ 2007 using a decision chart.

Trait	**Male**	**Female**
Size	**Large and rugged**	Small and gracile
Ilium	**High and vertical**	Low and flat
Pubic shape	**Narrow and rectangular**	Broad and square
Subpubic angle	**V - shaped**	U – shaped

Obturator foramen	**Large and ovoid**	Small and triangular
Greater sciatic notch	**Narrow**	Wide
Preauricular sulcus	**Rare**	Well developed
Shaped of sacrum	**Long and narrow**	Short and broad

Table 84:- The morphological features of the pelvis in case 14 \ 1463 \ 2007.



Fig. 209:- The pelvis, case 14 \ 1463 \ 2007



Fig. 210:- Dorsal view of sacrum, case 14 \ 1463 \ 2007.

According to table 84, the sex of the case is mostly male.



Fig. 211:- Lateral view of the scapula, case 14 \ 1463 \ 2007.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to male.

Humerus = 33 cm

ST = 3.08 * (33) + 70.45, SE = 4.05

= 172.09

= 172.09 ± (4.05 * 2)

= 172.09 ± 8.1

= (163.99 - 180.19) cm

Ulna = 27cm

ST = 3.70 * (27) + 74.05, SE = 4.32

= 173.95

= 173.95 ± (4.32 * 2)

= 173.95 ± 8.64

= (165.31 - 182.59) cm

Femur = 46.7 cm

ST = 2.38 * (46.7) + 61.41, SE = 3.27

= 172.56

= 172.56 ± (3.27 * 2)

= 172.56 ± 6.54

= (166.02 - 179.1) cm

Tibia = 39.8 cm.

ST = 2.52 * 39.8 + 78.62, SE = 3.37

= 178.92

= 178.92 ± (3.37 * 2)

= 178.92 ± 6.74

= (172.18 – 185.66) cm

Fibula = 39.1 cm.

ST = 2.68 * 39.1 + 71.78, SE = 3.29

= 176.57

= 176.57 ± (3.29 * 2)

= 176.57 ± 6.58

= (169. 99 – 183.15) cm

According to the range chart, the stature of this case is (172.18 – 179.1 cm) (Fig. 212).

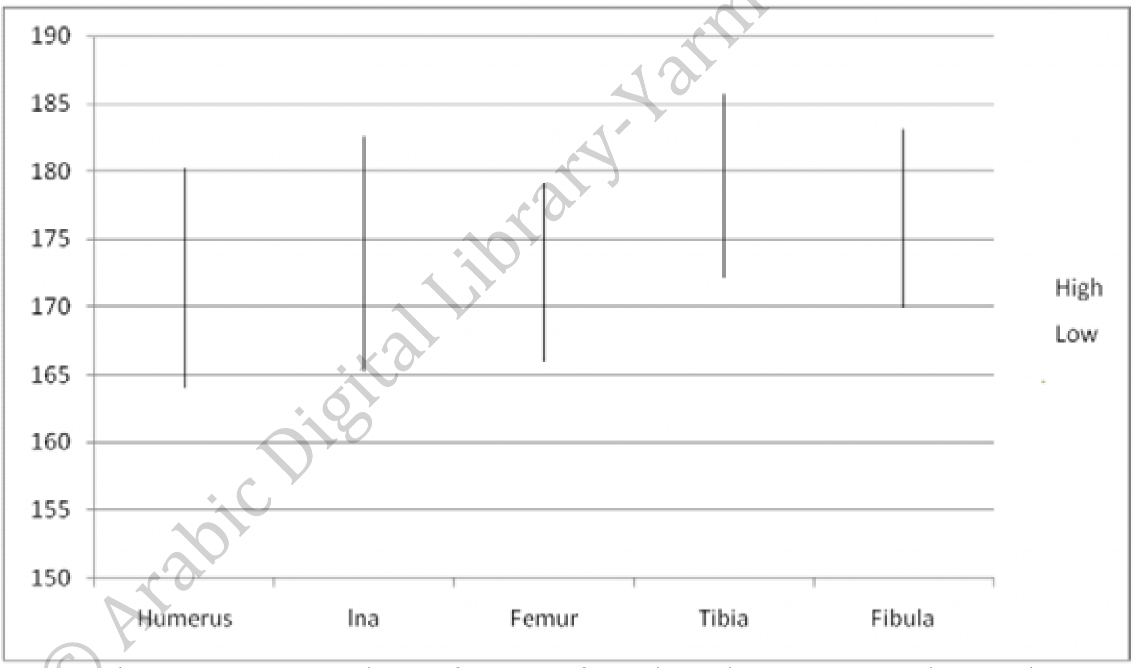


Fig. 212:- Range chart of stature from long bone, case 14 \ 1463 \ 2007.

Age estimation:-

1. The fusion of clavicle starts at the age of 27 and may continue to the age of 32 years old, the clavicle in this case is fused.

2. The auricular surface show from (35 – 38 years old). Striae still abundant but weak transverse and complete boss of billowing, uniform coarse granularity of the entire surface, slight retroauriclar no apical activity.

Based on these information and using the range chart, the estimated age is about (35 – 38 years old), (Fig. 214).



Fig. 213:- Posterior superior of pelvis, case 14 \ 1463 \ 2007.

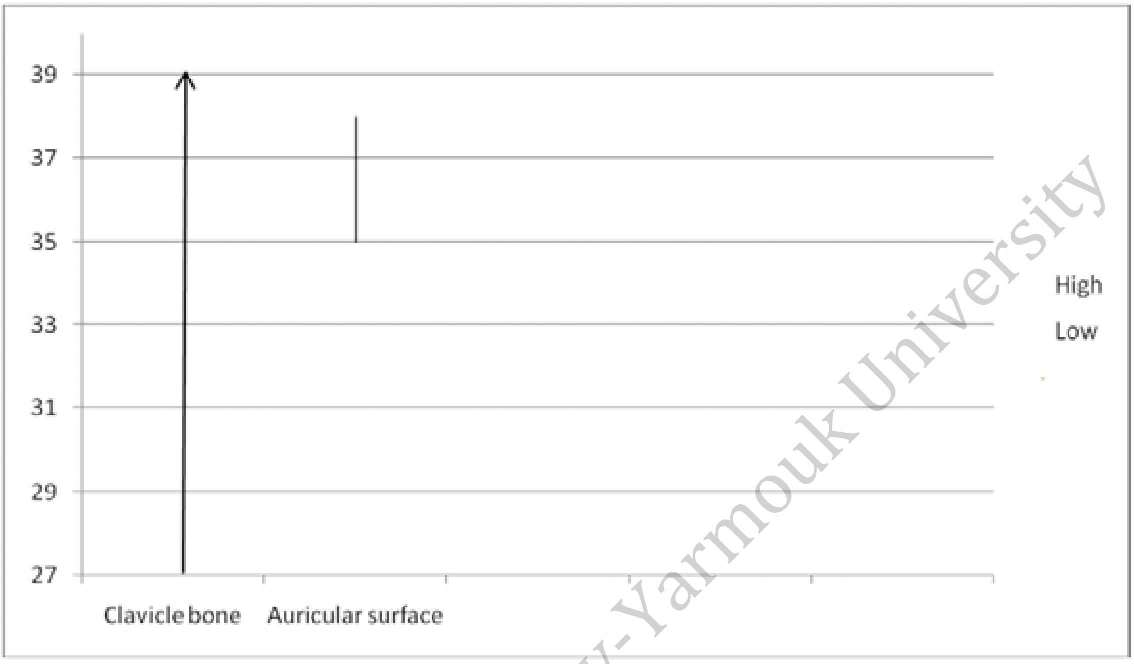


Fig. 214:- Range chart of age at death from auricular surface and clavicle bone, case 14 \ 1463 \ 2007.

Time elapsed since death (TESD): -

The lower extremities of the corpse witnessed adipocere formation, which suggest water submersion at the level of lower extremities. Full adipocere formation might be reached in less than a years. The decomposition in the vertebral column followed by plant growth, which means that TESD is more than 1.5 years but not less 10 months because mild wool deterioration happened in less than 10 months. Such a burial may exist in irrigated farm. This case did not have a police report as others did, which complicate the investigation procedure. This case is an example on the necessity of the presence of a forensic anthropologist whenever such a case shows up.

Cause of death:-

Unknown.

Manner of death:-

Unknown.

Summary:-

The case belongs to a male measuring about 172.18 – 179.1 cm in height. He died at about an age of 35 – 38 years old. The time elapsed since death is more than 1.5 years but not less than 10 months.

Case 15:- Group of bones at the forensic laboratory.

This case was brought to NIFM and remained to be investigated until the beginning of this study. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994). Table 1 below shows the inventory.

Bone inventory:-

Table 85:- The inventory of long bones of case 15 Forensic Laboratory.

Bone	Side	Preservation	Complete %	Fusion
Femur	Left	Intact	100%	Complete and discoloration



Fig. 215:- Femur, case 15 Forensic Laboratory.

Table 86: The inventory of the remaining bones of case 8 Forensic Laboratory.

Bone	Side	Preservation	Fusion
Skull		Intact	Complete and discoloration
Maxilla		Intact	Complete and discoloration
Mandible		Intact	Complete and

			discoloration
Sacrum		Intact	Complete and discoloration
Illium	Right	Intact	Complete and discoloration
Illium	Left	Intact	Complete and discoloration
Ischium	Right	Intact	Complete and discoloration
Ischium	Left	Intact	Complete and discoloration
Pubis	Right	Intact	Complete and discoloration
Pubis	Left	Intact	Complete and discoloration

Table 87: Dental inventory, case 15 Forensic Laboratory.

Tooth type	Side
UPM1	Right
UPM1	Left
UPM2	Right
UPM2	Left
UM1	Right
UM1	Left
UM2	Right
UM2	Right
UM3	Right
UM3	Left
LC	Right
LPM1	Right
LPM1	Left
LPM2	Right
LPM2	Left
LM1	Right
LM1	Left

LM2	Right
LM2	Left
LM3	Right
LM3	Left



Fig. 216:- The maxilla, case 15 Forensic Laboratory.



Fig. 217:- The mandible, case 15 Forensic Laboratory.

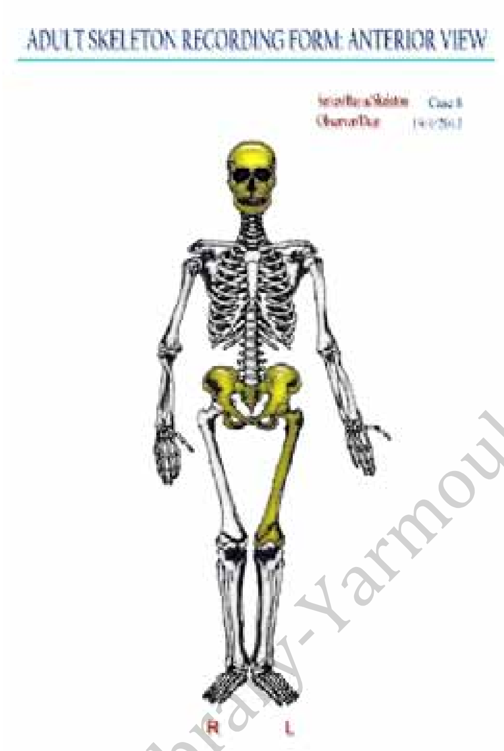


Fig. 218:- Skeletal recording of bones, case 15 Forensic Laboratory.

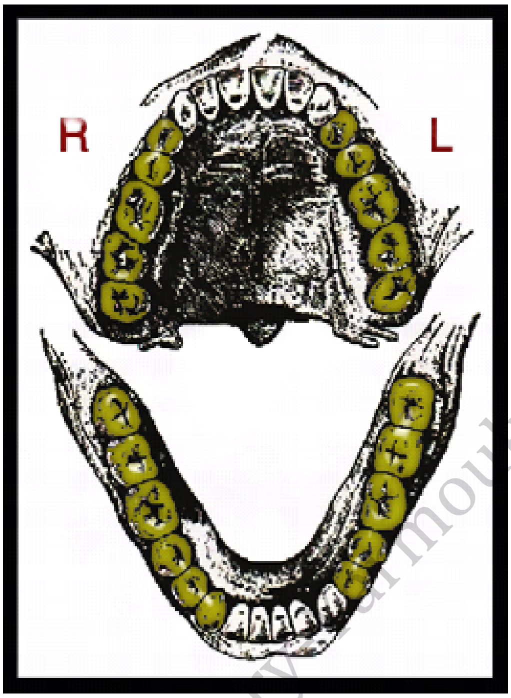


Fig 219:- Dental recording, case 15 Forensic Laboratory.

According to figures 208 and 209, some bones were missing. These bones were probably on the surface at that time.

Sex estimation:-

Tables 88 and 89 show the result of sex estimation of case number 8 Forensic Laboratory using a decision charts.

Trait	Males	Female
Size	**<u>Large and rugged</u>**	Small and gracile

Mastoid	**Large , projecting**	small , no projecting
Brow ridges	**Large**	Small , None
Frontal	**Slanted**	High , Rounded
Nucal area	**Rugged with hook**	Smooth, hook unknown
Supraorbital margin	**Rounded**	Sharp

Table 88:- The morphological features of the skull of case 15 Forensic Laboratory.



Fig. 220:- Lateral view of cranium, case 15 Forensic Laboratory.

Trait	Male	Female
Size	<u>**Large and rugged**</u>	Small and gracile
Ilium	<u>**High and vertical**</u>	Low and flat
Pubic shape	<u>**Narrow and rectangular**</u>	Broad and square
Subpubic angle	V - shaped	<u>**U – shaped**</u>
Obturator foramen	<u>**Large and ovoid**</u>	Small and triangular
Greater sciatic notch	<u>**Narrow**</u>	Wide
Preauricular sulcus	<u>**Rare**</u>	Well developed
Shaped of sacrum	<u>**Long and narrow**</u>	Short and broad

Table 89:- The morphological features of the pelvis in case 15 Forensic Laboratory.



Fig. 221:- Lateral view of the pelvis, case 15 Forensic Laboratory.



Fig. 222:- Dorsal view of the sacrum, case 15 Forensic Laboratory.

According to tables 88 and 89, the sex of the case is mostly male.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 90 shows the result of ancestry of case number 8 Forensic Laboratory.

Structure	whites	Blacks	Asians
Nose			
Root	**High , Narrow**	Low , Rounded	Low , Ridged
Bridge	**High**	Low	Low
Lower border	**Shape (sill)**	Guttered	Flat , Sharp
Spine	**Pronounced**	Small	Small
Width	**Narrow**	Wide	Medium
Face			
Profile	**Straight**	Projecting	Intermediate
Sharp	**Narrow**	Narrow	Wide
Eye orbits	**Angular**	Rectangular	Rounded
Lower eye border	**Receding**	Receding	Projecting
Vault			
Brow ridges	**Heavy**	Small	Small

Muscle marks Vault sutures Postbregma	**Rugged** **Simple** Straight	Smooth **Simple** **Depressed**	Smooth Complex Straight
Jaws and teeth Jaws Palatal shape	 **Small** **Parabolic**	 Large Hyperbolic	 Large Elliptical

Table 90:- The morphological features of the vault and jaws for case 15 Forensic Laboratory.



Fig. 223:- Anterior view of cranium, case 15 Forensic Laboratory.



Fig. 224:- Lateral view of the cranium, case 15 Forensic Laboratory.

Stature estimation:-

The stature is estimated based on the length of the available femur as follows taking into consideration that the case belongs to a white male.

Femur = 48 cm

ST = 2.38 * (48) + 61.41, SE = 3.27

= 175.65

= 175.65 ± (3.27 * 2)

= 175.65 ± (6.54) cm

= (169.11 – 182.19) cm

The stature of this case is (169.11 – 182.19 cm).

Age estimation:-

1. The sutures of skull give an age of 48 - above 60 years old.
2. Also the third molar is erupted 18 years and above.
3. The pubic symphsis show age from (30 – 35 years old), development and practical completion of ventral rampart. Retention of some granular appearance of symphyseal face indicating that activity has not yet ceased. Failure of ventral aspect of pubis adjacent to ventral rampart to become transformed into a compact surface. The rampart may therefore be somewhat undermined. Retention of the pectinate outline of the dorsal margin and slight ridge and furrow system. No lipping of ventral margin and no increased lipping of dorsal margin.
4. Auricular surface show from (31 – 34 years old). Stria strong on inferior demiface, significant transverse organization is evident especially on inferior demiface. Loss of transverse organization superiorly, uniform coarse granularity on superior demiface. Mostly fine granularity on inferior demiface, very slight retoauricular activity and no apical activity.

Based on these information and using the range chart, the estimated age is (31– 34 years old) (Fig. 227).



Fig. 225:- Anterior view of the pelvis, case 15 Forensic Laboratory.



Fig. 226:- Posterior superior of the pelvis, case 15 Forensic Laboratory.

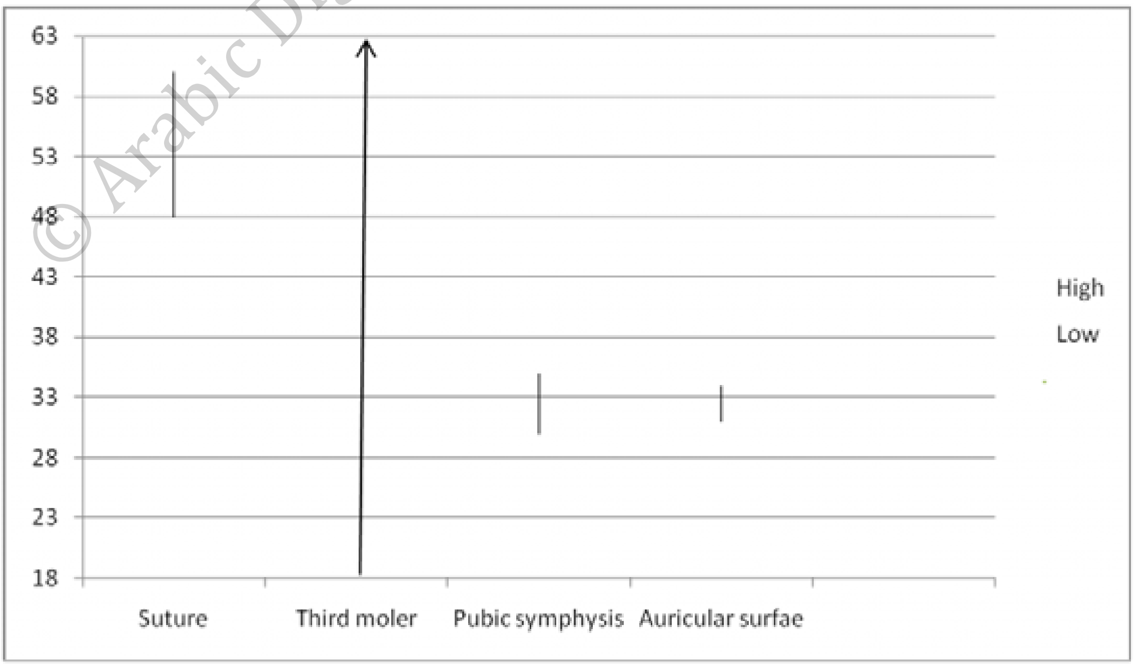


Fig. 227:- Range chart of age at death from third molar, pubic symphysis, auricular surface and suture of skull, case 15 Forensic Laboratory.

Time elapsed since death (TESD): -

This case did not have a police report, where the geographic location is not known. There were no associated materials. The TESD could not be established, and it is advised that a radiocarbon dating is obtained to establish a forensic context.

Cause of death: -

Unknown.

Manner of death:-

Unknown.

Summary:-

This case belongs to a white male measuring about 169.11 – 182.19 cm in height. He died at about an age of 31– 34 years old. The TESD is not known.

Case 16:- Bones of Al-Mafraq police.

This case was brought to NIFM and remained to be investigated until the beginning of this study. The cranium shows multiple fractures, the broken parts were reconstructed using tapes. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 228:- Superior-posterior view of the cranium, case 16, Al-Mafraq police.



Fig. 229:- Superior view of cranium, case 16, Al-Mafraq police.

Bone inventory:-

Table 91:- The inventory of long bones of case 16, Al-Mafraq police.

Bone	**Side**	**Preservation**	**Complete %**	**Fusion**
Tibia	Left	Broken	80%	



Fig. 230:- The tibia, case 16, Al-Mafraq police.

Table 92: The inventory of the remaining bones of case 16, Al-Mafraq police.

Bone	Side	Preservation	Fusion
Skull		Broken	Complete
Maxilla		Intact	Complete
Mandible		Intact	Complete
Scapula	Right	Intact	Complete
Scapula	Left	Broken	Complete



Fig. 231:- Anterior view of the scapula, case 16, Al-Mafraq police.

Table 93: Dental inventory, case 9, Al-Mafraq police.

Tooth type	Side
I2U	Left

I1L	Right
UC	Right
UC	Left
LC	Left
UPM1	Right
UPM1	Left
LPM1	Right
LPM1	Left
LPM2	Left
UM1	Right
UM1	Left
UM2	Right
UM2	Left
UM3	Left
LM1	Right
LM1	Left
LM2	Right
LM2	Left
LM3	Right

LM3	Left



Fig. 232:- The maxilla, case 16, Al-Mafraq police.



Fig. 233:- The mandible, case 16, Al-Mafraq police.

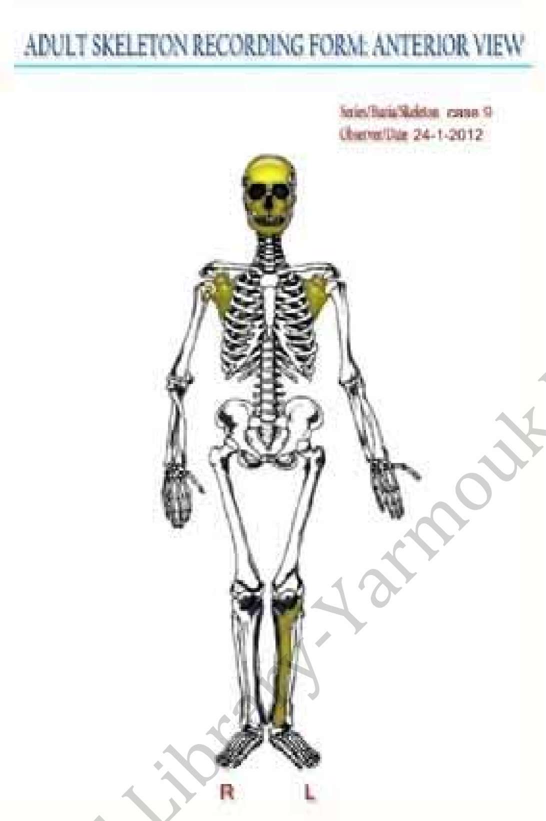


Fig. 234:- Skeletal recording of bones, case 16, Al-Mafraq police.

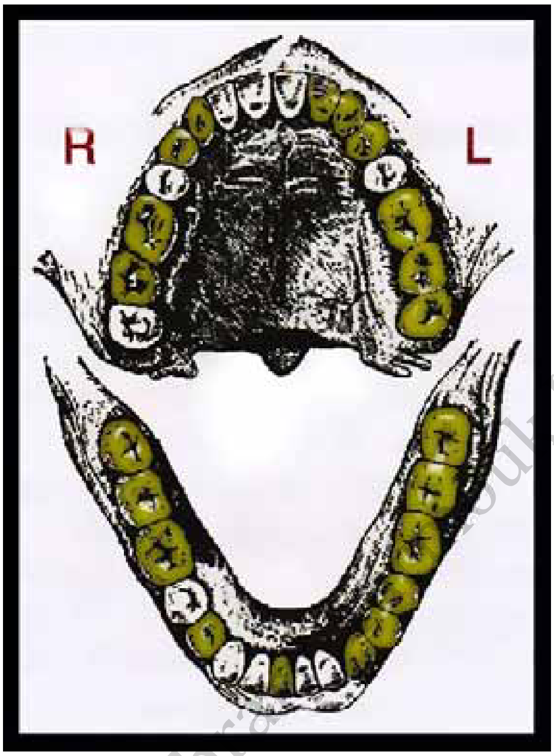


Fig 235:- Dental recording, case 16, Al-Mafraq police.

According to figures 234 and 235, some bones were missing.

Sex estimation:-

Tables 94 show the result of sex estimation of case number 16, Al-Mafraq police using a decision chart.

Trait	Males	Female
Size	**Large and rugged**	Small and smooth

Mastoid	**Large , projecting**	small , no projecting
Brow ridges	**Large**	Small, none
Frontal	Slanted	**High, rounded**
Nucal area	**Rugged with hook**	Smooth, hook uncommon
Supraorbital margin	**Rounded**	Sharp
Chin	**Broad**	Pointed

Table 94:- The morphological features of the skull of case 16, Al-Mafraq police.

According to table 94, the sex of the case is mostly male.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 95 shows the result of ancestry of case number 16, Al-Mafraq police.

Structure	**whites**	**Blacks**	**Asians**
Nose Root Bridge Lower border Spine Width	 **High ,** **Narrow** **High** **Shape (sill)** **Narrow**	 Low , Rounded Low Guttered Small Wide	 Low , Ridged Low Flat , Sharp Small Medium
Face Profile Sharp Eye orbits Lower eye border	 **Straight** **Narrow** **Angular** **Receding**	 Projecting Narrow Rectangular Receding	 Intermediate Wide Rounded Projecting
Vault Brow ridges Muscle marks Vault sutures Postbregma	 **Heavy** **Rugged** **Simple** **Straight**	 Small Smooth **Simple** Depressed	 Small Smooth Complex **Straight**
Jaws and teeth	**Small**	Large	Large

Jaws Palatal shape	**Parabolic** **Spatulate**	Hyperbolic **Spatulate**	Elliptical Shoveled

Table 95:- The morphological features of the vault and jaws for case 16, Al-Mafraq police.



Fig. 236:- Anterior view of the cranium, case 16, Al-Mafraq police.

Age estimation:-

The third molar usually erupts at the age of 18 years. Based on this information, the estimated age is above 18 years old.

Time elapsed since death (TESD): -

No associated materials were recovered along with the bones that can be detected. Also, the bones lack a geographical context. The TESD is more not known.

Cause of death: -

Bullet injury to right side of the head (upper temporal bone). Sever damage was resulted in the opposite side to the head (exit wound).



Fig. 237:- Lateral view of the cranium, case 16, Al-Mafraq police.



Fig. 238:- Lateral view of the cranium, case 16, Al-Mafraq police.

Manner of death: -

Homicide/suicide.

Summary:-

The case belongs to a white male. He died at an age above 18 years old due to a bullet injury at the right side of the head. The time elapsed since is not known due to the lack of geographic context and associated materials.

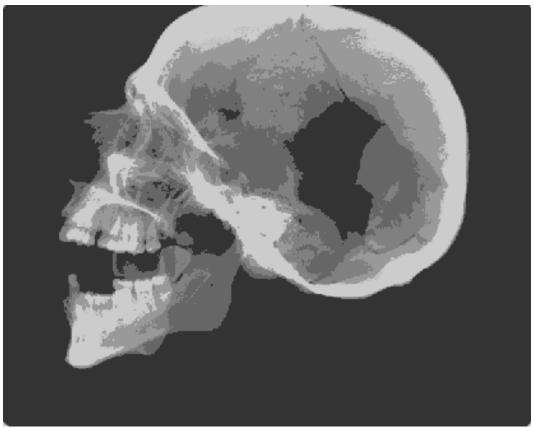


Fig. 239:- X-ray of the cranium shows the radiating fracture in the parietal bone, case 16, Al-Mafraq police.



Fig. 240:- X-ray of the cranium shows the radiating fracture in the parietal bone, case 16, Al-Mafraq police.

Case 17:- 2835 \ 2010, Groups of Sahab bones.

This case was brought to NIFM by Sahab Policemen on 19\10\2010 and remained to be investigated until the beginning of this study. Bones of a cat were also found. The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 241:- Animal bone, case 17 \ 2835 \ 2010 groups of Sahab bones.

Bone inventory:-

Table 96:- The inventory of long bones of case 17 \ 2835 \ 2010 groups of Sahab bones.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Right	Intact	100%	Complete, discoloratio n to black.
Clavicle	Left	Intact	100%	Complete, discoloratio n to black
Humerus	Right	Intact	100%	Complete, discoloratio n to black
Humerus	Left	Intact	100%	Complete, discoloratio n to black
Radius	Right	Intact	100%	Complete, discoloratio n to black
Femur	Right	Intact	100%	Complete, discoloratio

				n to black
Tibia	Right	Intact	100%	Complete, discoloration to black
Tibia	Left	Intact	100%	Complete, discoloration to black
Fibula	Right	Intact	100%	Complete, discoloration to black
Fibula	Left	Intact	100%	Complete, discoloration to black



Fig. 242:- Long bones (right and lift humerus, right radius, right femur, right and tibia and right and fibula), case 17 \ 2835 \ 2010 groups of Sahab bones.

Table 97: The inventory of the remaining bones of case 17 \ 2835 \ 2010 groups of Sahab bones.

Bone	Side	Preservation	Fusion
Scapula	Right	Intact	Complete, discoloration to black
Scapula	Left	Intact	Complete, discoloration to black
Metatarsals	Right	Intact	Complete, discoloration to black
Metatarsals	Left	Intact	Complete, discoloration to black



Fig. 243:- Right and scapula, case 17 \ 2835 \ 2010 groups of Sahab bones.

Table 98: The inventory of the vertebrae of case 17 \ 2835 \ 2010 groups of Sahab bones.

Vertebrae	**Type**	**Preservation**	**Fusion**
Cervical (1 – 7)	1 - 2	Intact	Complete, discoloration to black
Thoracic (8 – 12)	8 – 12	Intact	Complete, discoloration to black
Lumbar (13 – 17)	13 - 16	Intact	Complete, discoloration to black



Fig. 244:- The vertebrae, case 17 \ 2835 \ 2010 groups of Sahab bones.

Table 99: The inventory of ribs of case 17 \ 2835 \ 2010 groups of Sahab bones.

Ribs	**Side**	**Preservation**
Rib 1	Left	Intact, discoloration.
Ribs (3 – 7)	Right	Intact, discoloration.
Ribs (3 – 7)	Left	Intact, discoloration.
Ribs (8 – 10)	Right	Intact, discoloration.
Ribs (8 – 10)	Left	Intact, discoloration.
Ribs (11 – 12)	Right	Intact, discoloration.
Ribs (11 – 12)	Left	Intact, discoloration.



Fig. 245:- The ribs, case 17 \ 2835 \ 2010 groups of Sahab bones.



Fig. 246:- Skeletal recording of bones, case17 \ 2835 \ 2010 groups of Sahab bones.

According to figure 246, some bones were missing.

Sex estimation:-

The length of the glenoid cavity = 43 mm, the maximum length of scapula = 17.5 cm and the measurement of vertical head of humerus = 50 mm all of this indicate that the sex is male.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a male.

Humerus = 33.3 cm

ST = 3.08 * (33.3) + 70.45, SE = 4.05

= 173.01

= 173.01 ± (4.05 * 2)

= 173.01 ± 8.1

= (164.91 - 181.11) cm

Radius = 25.3 cm

ST = 3.78 * (25.3) + 79.01, SE = 4.32

= 174.64

= 174.64 ± (4.32 * 2)

= 174.64 ± 8.64

= (166 - 183.28) cm

Tibia = 39.2 cm.

ST = 2.52 * (39.2) + 78.62, SE = 3.37

= 177.40

= 177.40 ± (3.37 * 2)

= 177.40 ± 6.74

= (170.66 – 184.14) cm

Fibula = 38.4 cm.

ST = 2.68 * (38.4) + 71.78, SE = 3.29

= 174.70

= 174.70 ± (3.29 * 2)

= 174.70 ± 6.58

= (168.12 – 181.28) cm

According to the range chart, the stature of this case between (177.66 – 181.11 cm) (Fig. 247).

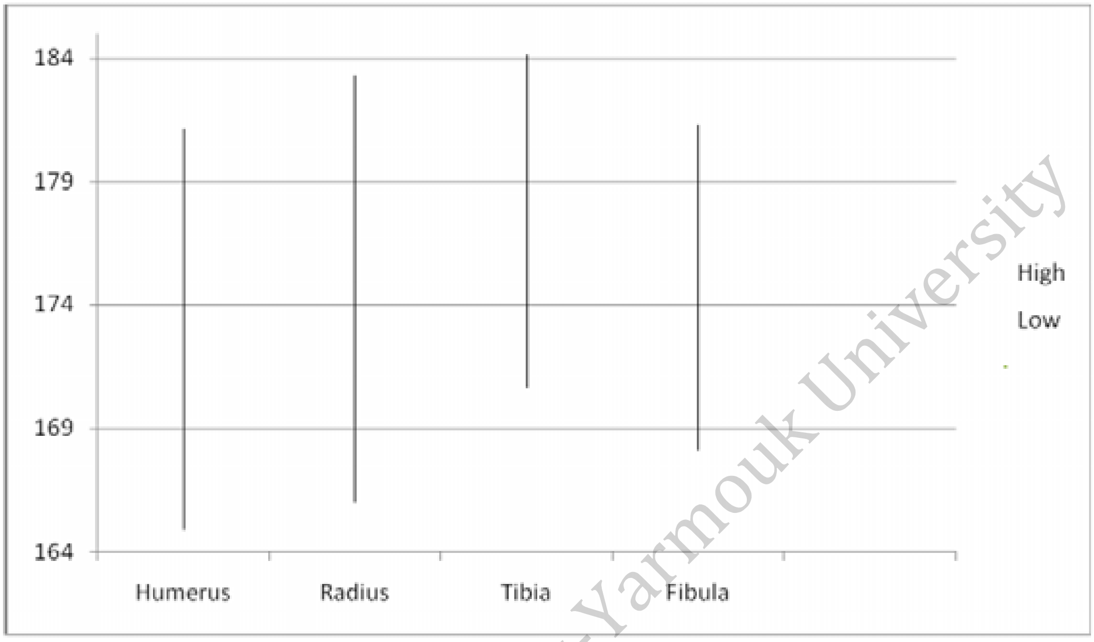


Fig. 247:- Range chart of stature from long bones, case 17 \ 2835 \ 2010 groups of Sahab bones.

Age estimation:-

1. The fusion of clavicle starts at the age of 27 and may continue to the age of 32 years old, the clavicle of this case is fused.
2. Third molar usually erupts at the age of 18 years old; the third molar is erupted.

Based on this information and using the range chart, the estimated age is above 27 years old (Fig. 248).

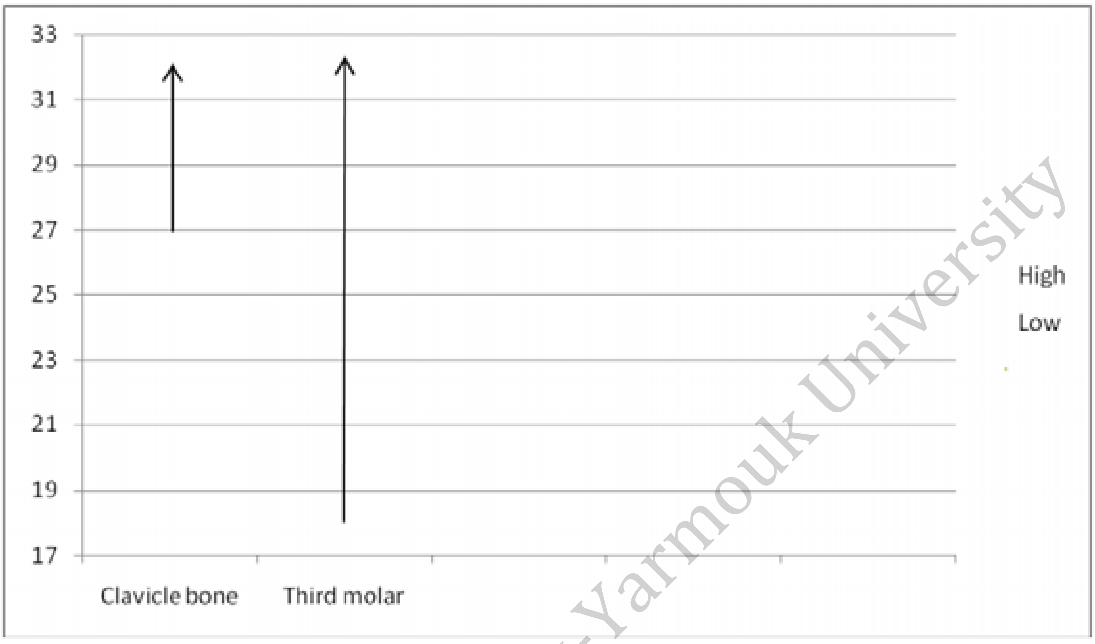


Fig. 248:- Range chart of age at death from the third molar and clavicle bone; case 17 \ 2835 \ 2010 groups of Sahab bones.

Time elapsed since death (TESD): -

Although the geographical location is known, where we can establish a range for the TESD, the dark discoloration of the bones possesses a problem. This indicates that the burial environmental is wet as all of the bones were uniformly discolored. Second, the burial environment (liquid, wet soil, …etc.) has a dark color that stained the bones. Raman spectroscopy is useful in identification the material that stained the bone but unfortunately this technique is not available in Jordan. It is known that the sewage may stain the bones in such a manner. Radiocarbon dating is not helpful here as the

bones were contaminated. But to establish a forensic context, FTIR and Raman spectroscopy may do the job.

Cause of death: -

Unknown.

Manner of death:-

Unknown.

Summary:-

The case belongs to a white male measuring about (177.66 – 181.11 cm) in height. He died at an age above 27 years old. The time elapsed since death is not known.

Case 18:- 6762

This case was brought to NIFM and remained to be investigated until the beginning of this study. There were desiccated tissues in the frontal, occipital and right parietal bones. There were fractures in right side of cranium (parietal and occipital). The inventory of the bones was scored according to the standards by Buikestra and Ubelaker (1994).



Fig. 249:- Superior view of the cranium, case 18 \ 6762.



Fig. 250:- Lateral view of the cranium, case 18 \ 6762.



Fig. 251:- Soft mummified tissue in the occipital, case 18 \ 6762.

Bone inventory:-

Table 100: The inventory of the remaining bones of case 18 \ 6762.

Bone	Side	Preservation	Fusion
Cranium		Fractured	Complete
Maxilla		Intact	Complete
Mandible		Intact	Complete

Table 101: The inventory of the vertebrae of case 18 \ 6762.

Vertebrae	Type	Preservation	Fusion
Cervical (1 – 7)	2	Broken	Complete



Fig. 252:- Fragment of the base bone of the skull, case 18 \ 6762.

Table 102: Dental inventory, case 18 \ 6762.

Tooth type	Side
UM1	Right
UM2	Right
UM1	Left
UM2	Left
LI2	Right
LC	Right
LC	Left
LPM1	Right
LM1	Right
LM2	Right
LM3	Right

LPM1	Left
LPM2	Left
LM2	Left
LM3	Left



Fig. 253:- Inferior view of the maxilla, case 18 \ 6762.



Fig. 254:- Superior view of mandible, the incisors, right canine and lift premolar fracture, case 18 \ 6762.

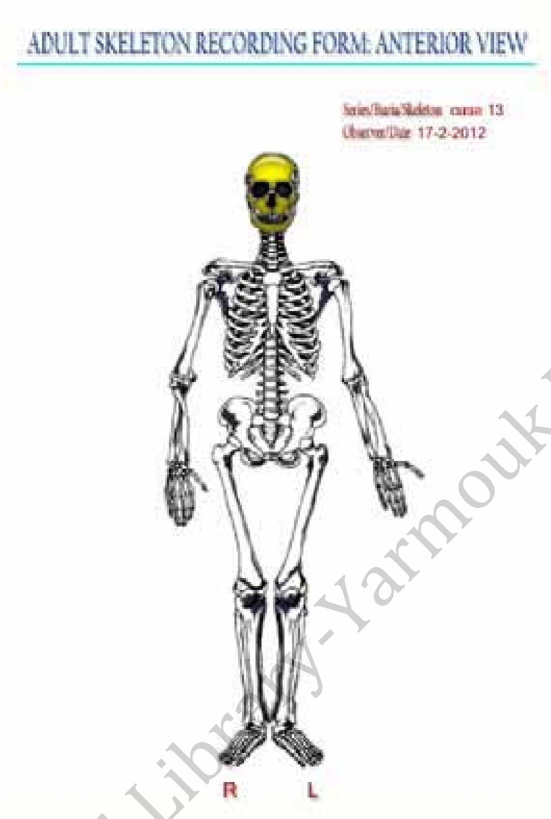


Fig. 255:- Skeletal recording of bones, case 18 \ 6762.

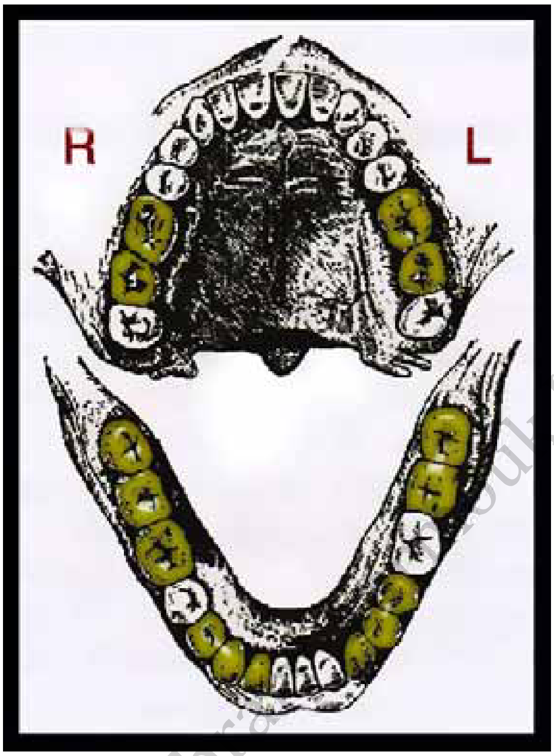


Fig 256:- Dental recording, case 18 \ 6762.

According to figures 255 and 256, some bones were missing

Sex estimation:-

Tables 103 show the result of sex estimation of case number 18 \ 6762 using a decision chart.

Trait	Males	Female
Size	**Large and rugged**	Small and smooth

Mastoid	**Large , projecting**	small, non projecting
Brow ridges	**Large**	Small, none
Frontal	**Slanted**	High, rounded
Nucal area	**Rugged with hook**	Small, hook uncommon
Supraorbital margin	**Rounded**	Sharp

Table 103:- The morphological features of the skull of case 18 \ 6762.



Fig. 257:- Left lateral view of the cranium, case 18 \ 6762.

According to table 103, the sex of the case is mostly male.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is black. Table 104 shows the result of ancestry of case number 18 \ 6762.

Structure	**whites**	**Blacks**	**Asians**
Nose			
Root	High , Narrow	**Low ,**	Low , Ridged
Bridge		**Rounded**	
Lower border	High	**Low**	Low
Spine	Shape (sill)	Guttered	**Flat , Sharp**
Width	Pronounced	**Small**	Small
	Narrow	Wide	**Medium**
Face			
Profile	Straight	**Projecting**	Intermediate
Sharp	**Narrow**	**Narrow**	Wide
Eye orbits	**Angular**	Rectangular	Rounded
Lower eye border	**Receding**	**Receding**	Projecting
Vault			

Brow ridges Muscle marks Vault sutures Postbregma	Heavy Rugged Simple **<u>Straight</u>**	**<u>Small</u>** **<u>Smooth</u>** Simple Depressed	**<u>Small</u>** **<u>Smooth</u>** **<u>Complex</u>** **<u>Straight</u>**
Jaws and teeth Jaws Palatal shape	 **<u>Small</u>** Parabolic	 Large **<u>Hyperbolic</u>**	 Large Elliptical

Table 104:- The morphological features of the vault and jaws for case 18 \ 6762.



Fig. 258:- Anterior view of the cranium, case 18 \ 6762.

Age estimation:-

The suture of the skull 27 – 43 years old.

Time elapsed since death (TESD): -

This case is not having police report, but the partial desiccation happen in hot and dry climates. So the TESD could be from 3 months to over 3 years.

Cause of death: -

Head injury is mostly premortem because the line of fracture is rugged and the fracture show radiating lines. This type of head injury is caused by blunt trauma.



Fig. 259:- Temporal bone fracture, case 18 \ 6762.



Fig. 260:- Inferior view of cranium, case 18 \ 6762.

Manner of death: -

Homicide.

Summary:-

The case belongs to a black's male. He died at about an age above 27 years old due to a blunt trauma to the right side of the cranium. The time elapsed since death is reached to 3 months to over 3 years.



Fig. 261:- X-ray of the cranium that shows the radiating fracture in the parietal bone, case 18 \ 6762.

Case 19:- 1492 \ 2010 Ma'an.

This case was brought to NIFM on 24\5\2010 and remained to be investigated until beginning of this study. They found the bones in a desert area characterized by valleys and mountains in the 24 \ 5 \ 2010 in Ma’an. The vertebrae column and second and third (carpal, metacarpal and phalanges) were found connected, there were desiccated tissues in cranium, pelvis and vertebral. The clavicle and radius bone were not fused, the scapula and ribs were broken, this fracture is mostly postmortem.



Fig. 262:- Superior-posterior view of the cranium, case 19 \ 1492 \ 2010 Ma’an.



Fig. 263:- The maxilla, case 19 \ 1492 \ 2010 Ma'an.



Fig. 264:- Lateral view of pelvis, case 19 \ 1492 \ 2010 Ma'an.



Fig. 265:- Two lumbar connected vertebrae case 19 \ 1492 \ 2010 Ma'an.



Fig. 266:- Second and third metacarpal bones, case 19 \ 1492 \ 2010 Ma'an.

Bone inventory:-

Table 105:- The inventory of long bones of case 19 \ 1492 \ 2010 Ma'an.

Bone	Side	Preservation	Complete %	Fusion
Clavicle	Right	Intact	100%	Not fused
Clavicle	Left	Intact	100%	Not fused
Humerus	Right	Intact	100%	Complete
Humerus	Left	Intact	100%	Complete
Radius	Right	Intact	100%	Not fused
Radius	Left	Intact	100%	Not fused

Ulna	Right	Intact	100%	Complete
Ulna	Left	Intact	100%	Complete
Femur	Right	Intact	100%	Complete
Femur	Left	Intact	100%	Complete
Tibia	Right	Intact	100%	Complete
Tibia	Left	Intact	100%	Complete
Fibula	Right	Broken	90%	Complete



Fig. 267:- The l Long bones (right and femur, right and tibia, right fibula, right and humures, right and lift radius and right and lift ulna), case 19 \ 1492 \ 2010 Ma'an.

Table 106: The inventory of the remaining bones of case 19 \ 1492 \ 2010 Ma'an.

Bone	**Side**	**Preservation**	**Fusion**
Skull		Intact	Complete
Maxilla		Intact	Complete
Scapula	Right	Broken	Complete
Scapula	Left	Intact	Complete
Illium	Right	Intact	Complete
Illium	Left	Intact	Complete
Ischium	Right	Intact	Complete
Ischium	Left	Intact	Complete
Pupis	Right	Intact	Complete
Pupis	Left	Intact	Complete
Sacrum			Complete
Metacarpals	Right	Intact, second	Complete

		and third	
Metatarsals	Right	Intact	Complete, shortage
Metatarsals	Left	Intact	Complete, shortage



Fig. 268:- The scapulae, case 19 \ 1492 \ 2010 Ma'an.

Table 107: The inventory of the vertebrae of case 19 \ 1492 \ 2010 Ma'an.

Vertebrae	**Type**	**Preservation**	**Fusion**
Cervical (1 – 7)	1 - 7	Broken	Complete
Thoracic (8 – 12)	8 – 11	Broken	Complete
Lumbar (13 – 17)	13 - 15	Broken	Complete

Table 108: The inventory of the ribs of case 19 \ 1492 \ 2010 Ma'an.

Ribs	Side	Preservation
Rib 1	Right	Intact
Rib 1	Left	Intact
Rib 2	Right	Intact
Rib 2	Left	Intact
Ribs (3 – 7)	Right	Fragments
Ribs (3 – 7)	Left	Fragments
Ribs (8 – 10)	Right	Fragments
Ribs (8 – 10)	Left	Fragments
Ribs (11 – 12)	Right	Fragments
Ribs (11 – 12)	Left	Fragments



Fig. 269:- Skeletal recording of bones, case 19 \ 1492 \ 2010 Ma'an.

According to figure 269, some of the bones were missing. These bones were probably on the surface at that time, or probably the site was not excavated properly.

Sex estimation:-

Tables 109 and 110 show the result of sex estimation of case number 19 \ 1492 \ 2010 Ma'an using a decision chart.

Trait	**Males**	**Female**
Size	**Large and rugged**	Small and smooth
Mastoid	**Large , projecting**	small , nonprojecting
Browridges	**Large**	Small, none
Frontal	**Slanted**	High, rounded
Nucal area	**Rugged with hook**	Smooth, hook uncommon
Supraorbital margin	**Rounded**	Sharp
Chin	**Broad**	Pointed

Table 109:- The morphological features of the cranium of case 19 \ 1492 \ 2010 Ma'an.



Fig. 270:- Lateral view of the cranium, case 19 \ 1492 \ 2010 Ma'an.

Trait	Males	Females
Size	**Large and rugged**	Small and gracile
Ilium	**High and vertical**	Low and flat
Pubic shape	**Narrow and rectangular**	Broad and square
Subpubic angle	**V - shaped**	U – shaped

Obturator foramen	**Large and ovoid**	Small and triangular
Greater sciatic notch	**Narrow**	Wide
Shaped of sacrum	**Long and narrow**	Short and broad

Table 110:- The morphological features of the pelvis in case 19 \ 1492 \ 2010 Ma'an.



Fig. 271:- Lateral view of the pelvis, case 19 \ 1492 \ 2010 Ma'an.

According to tables 109 and 110, the sex of the case is mostly male.

Ethnic affiliation:-

Based on the decision charts below, the ancestry is white. Table 111 shows the result of ancestry of case number 19 \ 1492 \ 2010 Ma'an.

Structure	**whites**	**Blacks**	**Asians**
Nose			
Root	High , Narrow	**Low , Rounded**	Low , Ridged
Spine	**Pronounced**	Small	Small
Width	Narrow	Wide	**Medium**
Face			
Profile	**Straight**	Projecting	Intermediate
Sharp	**Narrow**	**Narrow**	Wide
Eye orbits	**Angular**	Rectangular	Rounded
Lower eye border	**Receding**	**Receding**	Projecting
Vault			
Browridges	**Heavy**	Small	Small
Muscle marks	**Rugged**	Smooth	Smooth
Vault sutures	**Simple**	**Simple**	Complex
Postbregma	**Straight**	Depressed	**Straight**
Jaws and teeth			
Jaws	**Small**	Large	Large

Palatal shape	Parabolic	Hyperbolic	**Elliptical**

Table 111:- The morphological features of the vault and jaws for case 19 \ 1492 \ 2010 Ma'an.



Fig. 272:- Anterior view of the cranium, case 19 \ 1492 \ 2010 Ma'an.

Stature estimation:-

The stature is estimated based on the length of the available and complete long bones as follows taking into consideration that the case belongs to a white male.

Humerus = 29.6 cm

ST = 3.08 * (29.6) + 70.45, SE = 4.05

= 161.62

= 161.62 ± (4.05 * 2)

= 161.62 ± 8.1

= (153.52 - 169.72) cm

Ulna = 22.4cm

ST = 3.70 * (22.4) + 74.05, SE = 4.32

= 156.93

= 156.93 ± (4.32 * 2)

= 156.93 ± 8.64

= (148.29 - 165.57) cm

Radius = 21.1cm

ST = 3.78 * (21.1) + 79.01, SE = 4.32

= 158.77

= 158.77 ± (4.32 * 2)

= 158.77 ± 8.64

= (150.13 - 167.41) cm

Femur = 41.5 cm

ST = 2.38 * (41.5) + 61.41, SE = 3.27

= 160.18

= 160.18 ± (3.27 * 2)

= 160.18 ± 6.54

= (153.64 - 166.72) cm

Tibia = 33.9 cm.

ST = 2.52 * (33.9) + 78.62, SE = 3.37

= 164.05

= 164.05 ± (3.37 * 2)

= 164.05 ± 6.74

= (157.31 – 170.79 cm).

According to the range chart, the stature of this case between (153.64 – 165.57 cm) (Fig. 273).

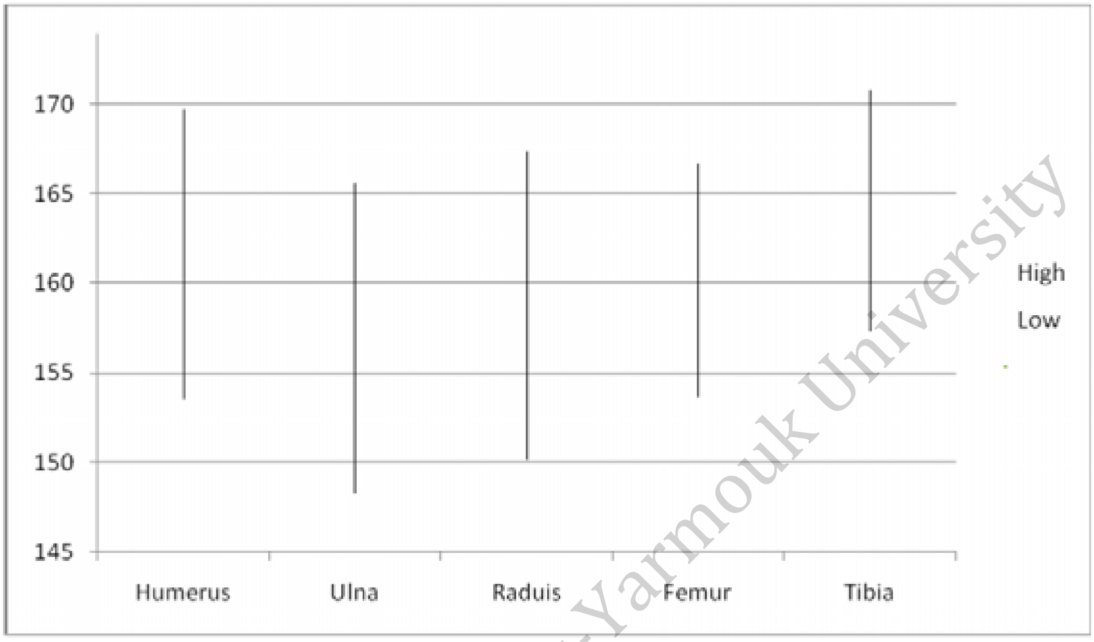


Fig. 273:- Range chart of stature from long bones, case 19 \ 1492 \ 2010 Ma’an.

Age estimation:-

1- The clavicle bone is not fused giving an age below 27 years old.

2- The radius is not fused giving an age below 23 years old.

3- The suture gives an age from 27 – 45 years old.

Based on this information and using the range chart, the estimated age at death is (18 – 23 years old) (Fig. 275).



Fig. 274:- Right and clavicle bones, case 19 \ 1492 \ 2010 Ma'an.

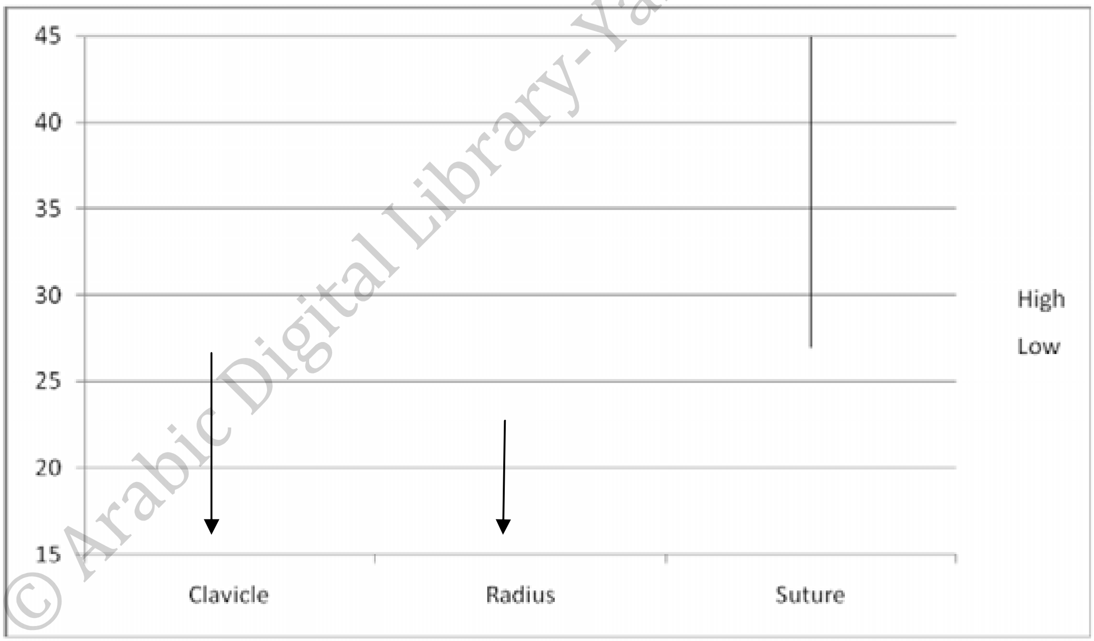


Fig. 275:- Range chart of age at death from the third molar and clavicle bone, case 19 \ 1492 \ 2010 Ma'an.

Time elapsed since death (TESD):-

This case was found in May in the desert area of Ma'an. This area is hot and dry in summer. The TESD is 3 months to over 3 years. The deterioration of the soft tissue moves the range of TESD to the it upper limit; about 3 years.

Cause of death: -

The bones seen health and the x-ray of the skull is normal (Fig. 230) and thus the cause of death is unknown.

Manner of death:-

Unknown.

Summary:-

The case belongs to a white male measuring about 153.64 – 165.57 cm in height. He died at about an age of 18 – 23 years old. The time elapsed since death is about 3 years.

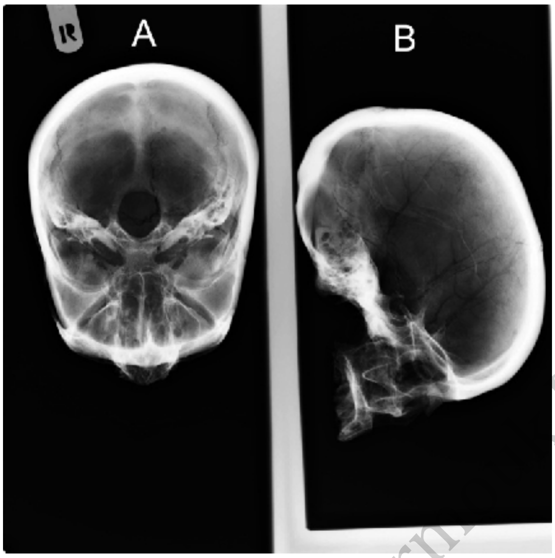


Fig. 276:- Inferior and lateral x-ray of the cranium case 19 \ 1492 \ 2010

Ma'an.

CHAPTER

Five

Chapter Four

Discussion

The number of female cases (12) is higher than the number of male cases (7); due to the small number of the examined cases the author can not elaborate on the higher incidence of female cases. In Finland, the number of female deaths is much lower than male ones, probably cultural specific (Virtanen, 2007). In an article conducted by Ellen (2010), he said that city growth is affected by changes in crime. They found in the 20th century, concerns about safety and high crime rates have beset US cities. Researchers and policymakers pointed to these high urban crime rates from which middle class and the white households fled during the post-war period, fueling suburbanization. But in 1990s, a decade during which the crime rate in the US fell by a 30%. In a cursory review of the literature provides evidence of a positive relationship between central city crime and suburbanization (Ellen, 2010).

The age at death ranges between 18-28 years old which matches the international figures, which is triggered by demographic, cultural, economic and law enforcement trends (Neven, 2007). The preservation condition of the corpses varied according to the geographical location and burial type, where

Jordan has at least three varied environments and geographical localities. The cause of death was estimated successfully in 9 cases (50%), mostly gunshots and blunt traumas. Geographically, the cases were distributed all over the area of Jordan, which means that there is no particular region that witnessed unidentified crimes or missing persons, unlike the western pattern which is concentrated in large urban centers (Cessato, 2011). This is probably triggered by the equality in the socio-cultural dimensions among the Jordanian. Except for one case, all of the cases were of a white ethnicity contrary to the study by Rushton (2009) on 113 countries who claimed that ethnicity is highly correlated to the incidence of crimes (Wong, 2012) on the Canadian populations. Russia, for example that has almost homogenous ethnic communities, has deaths of a white ethnicity. The social class and the economic status of the victims were not known; in Latin America for example (17 countries) most of the victims come from rich and middle class households and the cause of death was mostly murder (Gaviria, 2002).

All of the cases in this study were recovered during the period from 2007-2012, the time elapsed since death did not exceed 50 years in the known cases, which means that most of the cases are forensic and need detailed legal investigations. Most of the traumas in this study happened to the upper part of the body (head and chest), and the explained deaths might have

occurred relative to soft tissue disorder or to a death that did not interfere with the bone structure and morphology. It is substantial that the missing bones and teeth in the previous cases hid valuable information regarding the forensic protocol. In addition, the associated material evidence was probably gathered by untrained officials or even the public who reported on the presence of the case. This study, then, demonstrates the value of having a forensic anthropologist at the crime scene or even during the analysis of the human remains.

Until the writing of this study, forensic anthropology has been ignored by the NIFM in part due to the contempt that forensic anthropology has little to add to the analysis of skeletonized cases. On the other hand, these cases were stored at the NIFM as of no significant value either legally or medically. The police should have documented all of the necessary information regarding each case matching this information with the available missing reports all over the country. For this reason positive identification was not performed. In other words, if the manner of death in any of the cases was homicide, the murderer is probably free.

Forensic anthropology is currently a multidisciplinary approach, which integrated methods from physics, chemistry, and computer sciences. These methods may include stable isotope analysis, stochiochemistry, FTIR,

Raman spectroscopy, DNA analysis, X-ray radiography, Computerize Tomography scanning, X-ray diffraction, scanning electron microscopy, radiocarbon dating and others. In this study, radiocarbon dating was needed in cases that associated materials were not present and/or when stage of decomposition reaches full skeletonization. Raman spectroscopy and FTIR are needed to extract further evidence on the discoloration of the bones. Unfortunately, these techniques are expensive and some of them are not available in Jordan.

It is probable that some of the unidentified TESD cases might have been outside the scope of forensic science (TESD is more than 50 years). These cases remained enigmatic especially when dealing with mummified remains as in case 19. However, previous studies on similar cases proved that the TESD is less than 50 years (Al-Shorman, 2004), where certain geographical localities in Jordan dehydrates the corpse quickly and thus preserves the bodies for hundreds or even thousands of years (Al-Shorman A. A.-L., 2012). Except for three cases, the associated materials in the burial were totally absent that led to incomplete analysis of the case, particularly, causing a very wide range in the TESD. This study did not take full advantage of the dental morphology, structure and treatment as there were not dental records to compare to, and this is also applicable to ante mortem fractures,

pathologies, congenital anomalies and personal belongings. Consequently, the forensic anthropology was limited but at the same time all of the cases in this study were not legally requested by the NIFM to be analyzed.

Proportion of females than males in our existing cases, 12:7 this could lead to the several reasons, may be to crimes of honor, inheritance, civil disputes or rape or because of poor economic conditions.

Two cases in founded in Amman and the rest of the cases found in different areas from north to south (one case in South Shounah, two cases in the Northern Badia, one case in the Mafraq, two cases in Aqaba, two cases in the in Ma'an, two cases in the Jeza and one case in the Al-Karak), from my opinion, the reason for the spread of crimes in this areas due to the proliferation of firearms, and most likely there is no house without a weapon, whether it is used for hunting, protection or archaeological holdings.

Mostly, these cases is forensic, this leads to the spread of crime in recent times due to external openness and unemployment and poor economic conditions and decay between communities.

Unfortunately we don't found full skeleton this is due to several reasons, firstly due to the improper recovery bones from the grave in addition there are pieces of bone may think the person she stones or wooden pieces,

secondly could corpse be attacked by predators, thirdly,ؤ could have been a carcass to distort, especially in cases in which there is no skull, could be the skull had been buried elsewhere is the place the body, so it is necessary forensic anthropologist at the crime scene.

There are cases desiccated, partially skeletonization and there are cases fully skeletonization, there are several factors found working to influence on bone either reservation or working on decomposition (temperature and percentage of moisture in the soil and soil quality and quantity of salts in the soil). 90% of area in Jordan is hot and dry. In general, the areas is high temperature and quantity of salts working to preservation the body at odds of cases found in areas close to Sea it decomposition faster than another cases like case 7, in addition to the case existed in the sewer system decomposing fully as a result of chemical materials.

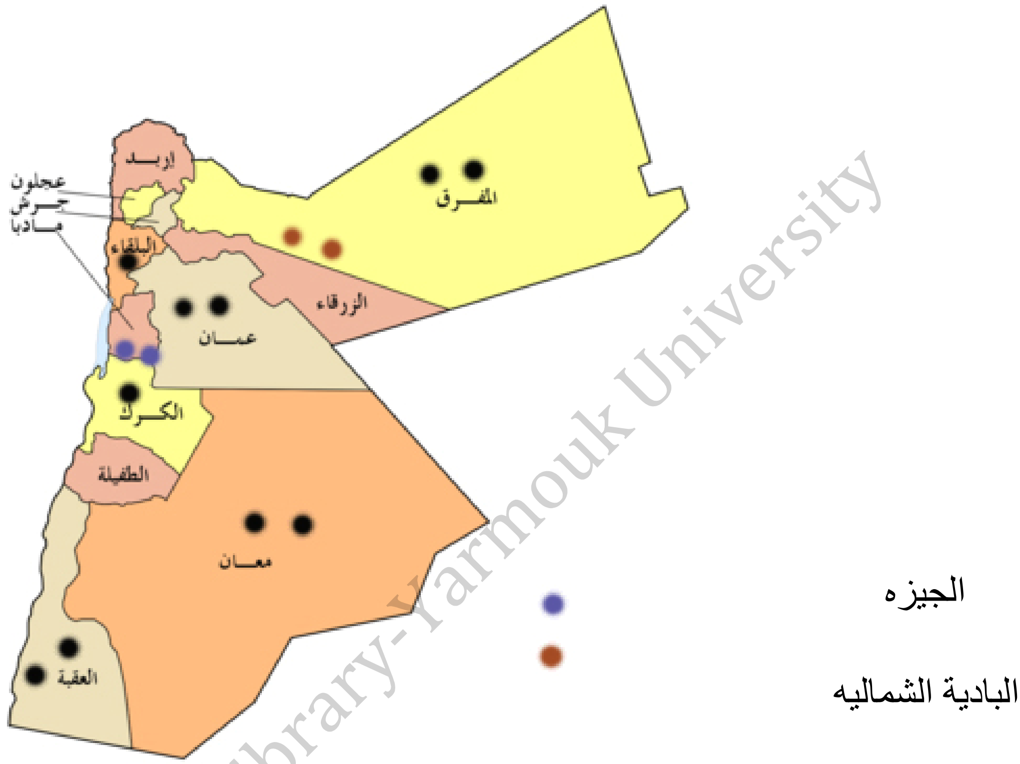


Fig 276:- Distribution of cases on the map

Table 112:- Concise Results

Case Number	Age	Sex	Race	Cause of Death	Manner of Death	Area	Time	State of Preservation	TESD
case 1:- 27/2011	more than 27	female	white	blunt trauma	unknown	Amman -Al naser	03/01/ 2011	Skeletonization	more than 2 months
case 2:- 2681	11	female	white	blunt trauma	unknown	South Shouna	15/10/ 2008	Skeletonization	more than 10 months
case 3:- 3284/2011	21	female	NA	unknown	unknown	Northen Badia	21/11/ 2011	Partly Skeletonization	2-10 months
case 4:- 1955	56	female	white	bullet injury	Homicid e	Northen Badia	NA	Skeletonization	0.5-10 months
case 5:- 3350/2011	abov e 18	female	white	bullet injury	Homicid e \ Suicide	Al- Mafra	2011	Skeletonization	10 months-
case 6:- 2185	32	female	NA	unknown	unknown	NA	NA	Partly Skeletonization	3 months
case 7:- 2145/2007	21	female	white	blunt trauma	Homicid e	Aqaba	20/08/ 2007	Skeletonization	2 years+2

									months
case 8:- 3371/2010	37	female	white	unknown	unknown	Ma'an- Al Jafr	15/12/ 2010	Partly Skeletonization	around 3.5 years
case 9:- B	34	female	white	gun shoot	Homicide /Suicide	NA	NA	Skeletonization	3 years
case 10:- 3081/2011	25	female	white	unknown	unknown	Al-Jeza	21/10/ 2011	Skeletonization	2 months to less the 8 years
case 11:- 957	21	female	white	unknown	unknown	Aqaba	06/04/ 2008	Skeletonization	Less than 6 months
case 12:- 1795	above 27	female	white		unknown	Al-Jeza	Un-known	Mummy	Un-known
case 13:- 1945/2007	32	male	white	blunt trauma	unknown	Al-karak	30/07/ 2007	Skeletonization	more than 6 months
case 14:- 1463/2007	36	male	NA	unknown	unknown	NA	2007	Partly Skeletonization	1.5 years

								with adipocers	
Case15	32	male	white	unknown	unknown	NA	NA	Skeletonization	Un-known
case 16	above 18	male	white	bullet injury	Homicide /Suicide	Al-Mafra	NA	Skeletonization	Un-known
case 17:-2835/2010	above 27	male	white	unknown	unknown	Amman-Sahab	19/10/2010	Skeletonization	Un-known
case 18:-1492/2010	20	male	white	unknown	unknown	Ma'an-Al Jafr	24/05/2010	Partly Skeletonization	3 years
case 19:-6762	27-43	male	black	blunt trauma	Homicide	NA	NA	Partly Skeletonization	3 months to over 3 years

Conclusion:-

In conclusion has been reached that there are many crimes that occur in Jordan and passes the time then it decomposition or become a mummy, pathologist cannot determine the identity or cause of death. The cause of death in most of the solved cases was determined by using forensic anthropological techniques can be used in the recovery and analysis of human remains. A forensic anthropologist assesses the age, sex, stature, ancestry, and evidence for an estimate of the predominant geographical ancestry of the individual, as well as to determine if the individual was affected by accidental or violent trauma or disease prior to or at the time of death.

The work of forensic anthropologist not just on the skeletal remains and mummies, but also on the burned and mutilated bodies that result from disasters either natural or non-natural and we can determine if the body is death based on disease or murder.

The forensic anthropologists frequently can work in conjunction with forensic pathologists, odontologists, and homicide investigators to identify a decedent, discover evidence of trauma, and determine the postmortem interval. Though they typically lack the legal authority to declare the official

cause of death, which is the job of forensic pathologists, their opinions are taken into consideration by the medical examiner. They may also testify in court as expert witnesses.

Recommendation

Forensic anthropology in Jordan should focus on forensic entomology in the future to extract more evidence regarding the time elapsed since death. In addition, DNA analysis should also be considered in cases where positive identification is needed. Radiocarbon dating of skeletal sample should also be used when suspicious cases are introduced (archaeological). Establish professional communication with the various legal authorities so that the forensic anthropologist can be at the scene.

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